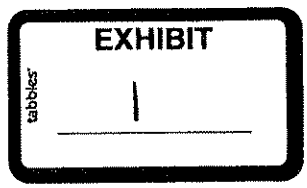
PUBLIC DOCUMENT

Comments of the China Chamber of Commerce of Metals, Minerals Chemicals Importers & Exporters on Market Oriented Enterprise

We are the China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters. With a membership of over 4,000, we are the largest and most representative association in the fields of metals, minerals and chemicals. We attach great importance to the issue of the DOC granting individual respondents market-economy treatment (MET) in anti-dumping proceedings and are grateful for the opportunity to comment.

With the following comments we argue that market economy status should be granted to China in anti-dumping investigations and that individual respondents should be considered for MET. For quite a long time, the US and China have held different opinions on China's market economy status. It is a prejudice against Chinese respondents that DOC refuses to recognize China's market-economy status.

It is well known China has established a market economy system over the past 20 years. The government, at both national and local levels, has faded out from direct involvement in the management of enterprises and become a macro regulator. It has no right to fix the prices for these enterprises, whether they are state-owned or privately owned, nor does it have the ability to influence prices by interfering in the purchase of raw materials, the channels of distribution, or company business practices. Additionally, a basic legal system for the market economy has been established in China. This system protects the independence and autonomy of enterprises, and ensures that the nature and quantity of the goods to be produced are decided by the producer at his



own will, according to the demand in the market. Even state-owned enterprises are operated under the rules of market economics. Therefore, domestic prices of Chinese products as a whole are not interfered with, and they are reliable. All Chinese enterprises operate in a competitive and fully open market that relies on supply and demand to for price determinations.

With regard to the methods employed by the United States to determine China's current market economy status, we believe that, the analyses are partial and the criteria used to decide whether or not to grant this status to China is doubtful. Although China's market economy is not perfect at present, this imperfection is quite normal. There is no perfect market economy in any country in the world, including those recognized as market economies by the U.S. The key issue is whether the U.S. will adopt the same criteria when granting market economy status to China as it did with other countries. In addition, the mechanism of market economy treatment itself is worth arguing on the grounds of accuracy and fairness. We are curious why it is necessary to conduct a complicated and rigorous investigation before granting market economy status to China when other countries were able to achieve such status almost automatically.

As the representative for China's metals, minerals and chemicals industries, we argue that these industries already meet U.S. standards of market oriented enterprise (MOE). We are puzzled as to why the DOC continues to use the same criteria to examine China's industries. Although the intention to grant individual respondent market economy treatment is a positive step, we think that the DOC should take into consideration that the overwhelming majority of Chinese enterprises already function within the rule

of the market economy without governmental influence. Currently, the vast majority of Chinese industries have met the three MOE criteria, yet none have been recognized as MOE.

We firmly believe that the market-based prices of Chinese enterprises should be compared to the broader economic environment when considering granting individual Chinese respondents MET. When calculating production cost, only the data submitted by the enterprises should be used to determine the cost of different factors of production, including labor, land, power, and water. Some parties think that the firms' input prices are distorted under the broader NME environment, but this conclusion is unfair. DOC should respect the fact that Chinese enterprises work under the rule of the market economy and should grant Chinese enterprises full MET instead of partial MET. Furthermore, DOC should remove the measure of "double counting" when conducting AD/CVD investigations against the products imported from China, as it is against U.S. law and its WTO obligations. It is unfair and discriminatory.

CEH Product Review

MAGNESIUM OXIDE AND OTHER MAGNESIUM CHEMICALS

By
Stefan Schlag
with
Jim Glauser and Kenji Fujita

CEH Product Reviews provide comprehensive analysis, historical data and forecasts pertaining to the international competitive market environment for chemical products. Detailed supply and demand data are developed for the United States, Western Europe and Japan with the cooperation of chemical producers and consumers worldwide.

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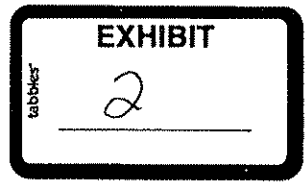


U.S. Supply/Demand for Magnesium Oxide (continued)
(thousands of metric tons, 100% MgO)

	Exports[b]				Apparent Consumption[a]		
	Refractory[e]	Caustic-Calcined[f]	Other[f]	Total[d]	Refractory	Caustic-Calcined and Other[c]	Total[d]
1975	75	8	--	83	710	105	815
1976	65	9	--	74	711	120	831
1977	69	11	--	80	625	111	736
1978	55	42	--	97	746	106	852
1979	30	62	--	92	822	92	914
1980	51	47	--	98	678	107	785
1981	19	33	--	52	609	123	732
1982	12	21	--	33	453	126	579
1983	10	15	--	25	477	143	620
1984	16	29	--	45	465	149	614
1985	23	20	--	42	403	130	534
1986	22	21	--	42	421	137	558
1987	13	20	--	33	486	121	607
1988	37	21	--	58	587	124	711
1989	23	4	16	43	528	197	725
1990	59	2	38	99	431	184	615
1991	66	4	25	95	377	237	614
1992	61	5	21	91	440	189	629
1993	60	5	22	87	487	250	737
1994	61	3	13	77	524	252	776
1995	75	2	12	89	552	279	831
1996	73	20	17	110	467	247	714
1997	66	5	22	93	496	284	780
1998	73	6	16	95	569	299	868
1999	73	3	17	93	535	300	835
2000	66	12	22	100	631	293	924
2001	67	4	37	108	509	242	751
2002	76	6	33	115	441	254	695
2003	65	4	29	98	398	292	690
2004	36	4	26	66	432	275	707
2005	30	5	25	60	493	277	770
2006	20	6	31	57	453	294	747

a. Data are for magnesium oxide shipped and used by producers and are assumed to approximately equal production. Includes magnesium oxide used by producers.

b. Beginning in 1989 the United States reclassified its trade reporting system to become part of the world harmonized trade system. Data before and after 1989 may or may not be comparable.

c. Excludes caustic-calcined magnesia used in the production of refractory magnesia. Includes USP and technical grades, and those grades made in a rotary kiln.

d. Totals may not equal the sums of the categories because of rounding.

Steel. Consumption of refractory magnesia in the steel industry is estimated at 390 thousand metric tons, with growth forecast to be flat at 0-1% annually from 2006 to 2011. The steel industry is by far the largest consumer of magnesium oxide. Monitoring the production of steel provides a general indication of the refractories industry. U.S. steel output increased 3.8% from 2005 to 2006, from 94.9 million to 98.5 million metric tons, but still down from 99.7 million metric tons in 2004. Meanwhile, North American steel output increased 3.1% from 2005 to 2006, from 127.6 million to 131.5 million metric tons. In 2004, North American production was 134 million metric tons.

As long as steel production continues to grow, consumption of DBM and FM will continue to grow, as well as prices. In the Americas, there are two diverging trends. In Central and South America, and in particular in Brazil, the production of DBM and FM will continue to supply the refractory segment. Meanwhile, in North America (United States, Canada and Mexico), production of synthetic DBM and FM has shifted to production of other magnesia specialties. The Americas are struggling to survive, caught between high energy costs and magnesia market prices. Only Brazil has been able to maintain its focus on refractories.

Over the past ten years, many open hearth and Bessemer steel furnaces have been replaced by electric arc and basic oxygen furnaces. When electric arc furnaces replace open hearth furnaces, water-cooled sidewalls and magnesium oxide–carbon brick in slaglines replace most of the magnesium oxide–chrome refractories previously used. Although demand for higher-purity grades of magnesium oxide has increased, the quantity of refractory magnesia required per ton of steel melted is far less than in the past. Total magnesia refractory consumption for electric arc furnaces is about 7 pounds per ton of steel, while for basic oxygen furnaces, it is slightly less. Back in 1980, it was in the range of 15-20 pounds of magnesia refractories per ton of steel produced.

Industry sources indicate that U.S. consumption fell by 80 thousand tons of magnesia per year (because of improved refractories and steelmaking practices) between 1984 and 1994. However, improvements in refractories and furnace processes have leveled off and little decline in consumption per ton of steel is expected. The main issue will be how much steel will be produced domestically in the next few years. If the steel industry continues to improve, consumption of dead-burned magnesia will continue to improve.

The following table presents U.S. steel production and MgO refractory consumption. Actual magnesium consumption in refractories is difficult to measure due to the proprietary nature of the refractories and the large number of formulations.

U.S. Production of Steel and Magnesium Oxide Refractory Consumption

	U.S. Steel Production (millions of metric tons)	MgO Refractories (kilograms per metric ton of steel)	MgO Refractory (millions of metric tons)
2000	101.8	4.87	0.496
2001	90.1	4.76	0.429
2002	91.6	4.64	0.425
2003	93.7	4.51	0.423
2004	99.7	4.35	0.434
2005	94.9	4.23	0.401
2006	98.5	4.09	0.403

SOURCE: CEH estimates.

Cement. Consumption of magnesium oxide for refractories in the cement industry is estimated at 45 thousand metric tons, with growth forecast at 1-2% annually during 2006-2[illegible]

The cement industry is growing faster than the steel industry. However, refractory consumption in the cement industry is much lower than in the steel industry, accounting for only about 10% of the steel industry demand for refractory material. Consumption was only 0.8 kilogram per metric ton of cement in 2004, down from one kilogram per metric ton in 1994. Current consumption averages 0.5 kilogram per metric ton (varying from 0.3 kilogram to 2.0 kilograms per metric ton) of cement. Similar to the steel industry, specific refractory consumption per metric ton is declining, but consumption is compensated for by the increase in cement production.

The cement industry is undergoing changes, replacing the older wet process (long kilns) with shorter rotary kiln technology. While this is reducing refractory consumption, it has resulted in more wear on refractory linings. As a result, newer brick technologies based on magnesium-alumina spinel and herzynith bricks are replacing magnesium chrome bricks. Demand for bricks that provide higher performance is expected to grow at 0.5% annually during 2006-2011. The modern kiln management system has reduced consumption from one kilogram refractory per thousand metric tons of clinker to 100 grams per thousand metric tons of clinker.

U.S. production of clinker has increased, from 81.9 thousand metric tons in 2003 to 90.0 thousand metric tons in 2006. The U.S. requirement for refractories is estimated at 80 thousand metric tons, and for North America, 90 thousand metric tons. Although demand for cement in North America is growing, the fact that producers are sold out for years to come is translating into declining demand for refractory products as cement companies are reluctant to take their kilns down for routine maintenance. As a result, consumption in 2005 was down an estimated 5-8%. In addition, as a result of hurricanes on the Gulf Coast (Katrina and Rita), replacement of wood with concrete in rebuilding could extend the sold-out conditions an additional five years. Slowing of the housing and general economy could have a positive impact on the sale of refractories, as delayed repairs are completed.

Other. Consumption in other applications is estimated at 18 thousand metric tons, with growth flat to 1%. Dead-burned magnesia is used in the production of cellulose acetate (5 thousand metric tons) and in leather tanning applications (<2 thousand metric tons). The remainder is consumed in other refractory applications, such as electrical-grade magnesia (EGM).

Electrical grade magnesia. EGM consumption in the United States is estimated at 6 thousand metric tons in 2006, and growth is expected to be stable at 0-1% annually during 2006-2011. Total North American consumption is estimated at 9 thousand metric tons.

According to sources, global consumption of EGM was 64 thousand metric tons in 2006, of which China accounts for 44%, Western Europe, 20%; North America, 14%; Eastern Europe, 10%; Far East (non-China), 6%; Near and Middle East, 5%; Central and South America, 1%; and Africa <1%. Total production of EGM-grade magnesia in the United States is 12 thousand metric tons, and in North America (United States, Canada and Mexico) 20 thousand metric tons. An estimated 8 thousand metric tons is produced by Peñoles at Saltia, Mexico.

This grade of magnesium oxide is used in sheathed electrical heating elements because of its unique combination of thermal conductivity and electrical resistivity at relatively high temperatures. Its main use is production of heating elements for electric furnaces and appliances. It is also used in domestic appliances, such as irons, washing machines, cooking plates, ovens, water heating elements, kilns, welding machines, and general heating systems. It is characterized by its high purity and relatively high silica content, which enhances its electrical properties.

Other Asian Producers of Magnesium Oxide (continued)

Company and Plant Location	Annual Capacity as of March 1, 2007 (thousands of metric tons)	Raw Material Source	Remarks
China (continued)			
Yingkou Great Magnesite Chemical Ind., Ltd. Nanlou-Ou, Dashiqiao, Liaoning	na	Magnesite	Produces mainly $MgSO_4$
Yingkou Xintian Tezhong Mineral Co., Ltd. Nanlou-Ou, Yinkou, Liaoning	20.0	Magnesite	
Yongan Science Co., Ltd. na	na	Magnesite	Produces a total of 10 thousand metric tons per year of $MgCO_3$, $Mg(OH)_2$ and MgO.
ZeHui Chemical (Wu Xi) Co., Ltd. Xihui Road, Xishan District, Guangzhou	3.0	Magnesite	Also produces 3 thousand metric tons of magnesium carbonate annually.
Zhao Zeng Zhi na	na	Magnesite	MgO with 95% purity. Private company.
Total	>3,300.0		
Korea, Republic of			
Posrec Refractories Co., Ltd.[a] Pohang, Kyongsangnam-do	40.0	Seawater	Refractory or fused.
Taiwan			
Long Rong Chemistry Co., Ltd. Peimen City, Tainan Hsien Yungan City, Kaohsiung Hsien	na na	Seawater Bittern	Caustic-calcined. Refractory or fused.
Nanmat Technology Co., Ltd. Nantzu District, Kaohsiung	na		Powder.
Total	>40		

a. Sole producer of dead-burned magnesite in the Republic of Korea, formerly Sam Hwa Chemical Co., Ltd.

SOURCE: CEH estimates.

China is a large producer and consumer of magnesium oxide. The easy and inexpensive processing and abundant magnesite deposits promote magnesium oxide production in China. Demonstrated magnesite deposits in China were estimated to be 1.7 billion metric tons in 2005, concentrated in Liaoning and Hebei provinces. There are more than 1,000 producers of magnesium oxide in China; of them, about twenty are major ones. Chinese steel production increased significantly, to 272.8 million metric tons in 2004, 353.5 million metric tons in 2005, and exceeded 400 million metric tons to 418.8 million metric tons in 2006. Consumption of refractory magnesia in China has increased accordingly. About 510 thousand metric tons of refractory magnesia (on a 100% MgO basis) is estimated to have been used for

steel production in 2006. Although there are no detailed statistics for production and markets, magnesium oxide capacity in China is estimated at over 3.3 million metric tons in 2006. About 2.0 million metric tons of magnesium oxide were exported from China in 2006, although magnesium oxide exports were restricted to 1.0 million metric tons for 2006 under the China E/I (Export License) Act. In 2006, 590 thousand metric tons, 500 thousand metric tons, 300 thousand metric tons, and 640 thousand metric tons of magnesium oxide were exported from China to Japan, Europe, the United States, and Other Asia, respectively.

In the past several years, total Other Asian consumption of magnesium oxide has been estimated to be about 1.0 million metric tons. Of this total, about 70% of consumption was by refractory magnesia, 19% by caustic-calcined magnesia, and 11% by fused magnesia. It is expected that there will be increases in demand for caustic-calcined magnesia in silicon steel and ferrite components, and increases in dead-burned magnesia for refractory uses.

In Malaysia, New World Alloys delayed purchase of the Addy, Washington magnesium plant in the United States because of lack of funding. New World Alloys still has plans to build a magnesium plant in Malaysia, although it will not necessarily be a relocation of the Addy plant. New World Alloys established a magnesium oxide plant in K Munting Industrial Estate near Tai Ping in late 2004. A quality dolomite (high MgO content and low levels of other impurities) seems to be available near the site. MgO capacity of the plant is estimated to be about 300 thousand metric tons annually.

The Russian-Vietnamese bilateral intergovernmental commission has been scheduled for up to 2010. The Russian government has proposed projects for building oil tanks and plants to produce tires, yellow phosphorus, soda ash and other chemical products. The Vietnamese government is proposing projects for magnesium oxide production and other chemical products.

The following table shows Chinese prices for dead-burned and fused magnesia:

Chinese Prices for Dead-Burned Magnesia and Fused Magnesia—2006
(dollars per ton ex-works)

	Domestic Sales	Export Prices
DBM9010	56.4-62.7	130-135
DBM91	60.1-68.9	130-140
DBM95	94-112.8	170-185
DBM97	111.6-112.8	240-245
DBM97.5	117.8-119.1	240-245
FM96	137.9-225.7	350
FM97	250.8-313.5	350-395
FM97.5	263.3-334.8	350-410

SOURCE: *Industrial Minerals*, September 2006.

OCEANIA

There are two magnesium oxide producers in Australia. Australian Magnesium Corp. Ltd. of Australia (AMC) produces dead-burned magnesia, electrofused magnesia and calcined magnesia through its subsidiary, Queensland Magnesia (QMAG). QMAG mines and processes magnesite from the Kunwarara magnesite deposit and produces the magnesia at its plant in Parkhurst, Queensland. QMAG has the

MAGNESIUM COMPOUNDS

By Deborah A. Kramer

Domestic survey data and tables were prepared by Jesse J. Inestroza, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Production of all magnesium compounds in the United States fell in 2002 compared with 2001, with the largest decrease, 42%, in production of dead-burned magnesia. Caustic-calcined magnesia production was 7% less than that in 2001. A stagnant economy and turmoil in the iron and steel industry were the main reasons for the production declines. Imports continued to supply a significant portion of U.S. magnesia demand, and this portion has become larger in recent years. Although U.S. refractory magnesia production dropped sharply, apparent consumption fell by only 13%. Even though production for caustic-calcined magnesia declined, U.S. apparent consumption increased by 5%. Imports of magnesia helped fill the U.S. production shortfall.

About 55% of U.S. magnesium compounds production came from seawater and well and lake brines. The remainder was recovered from magnesite, dolomite, olivine, and brucite. About 61% of the total consumption of magnesium compounds was for refractory applications. The remaining 39% was used in agricultural, chemical, environmental, and other applications. China remained the dominant supplier of imports for caustic-calcined and refractory magnesias with 60% and 73%, respectively, of the totals.

Production

Production of all magnesium compounds declined in 2002, with the sharpest decrease in refractory magnesia, which fell by 42% (table 3). The decline in refractory magnesia production could be attributed mainly to the stagnant economic conditions in the United States that persisted from 2001 and financial problems in the steel industry. By early 2002, about 29 U.S. steel companies had filed for bankruptcy, and 13 integrated and nonintegrated steelmakers closed. Two of the companies, Bethlehem Steel Corp. and LTV Steel Corp., represented about one-half of the steelmaking capacity and jobs in the industry. According to the American Iron and Steel Institute (undated§[1]), raw steel production in the United States in 2002 was 2.4% higher than that in 2001. Although this should have led to increased production of refractory magnesia because of a rise in demand by the steel industry, apparent consumption of dead-burned magnesia fell by 13%; an increase in net imports helped to meet U.S. demand. Although caustic-calcined magnesia production also was lower than that in 2001 (by 7%), apparent consumption increased by about 5%; again, an increase in net imports helped meet demand.

Data for magnesium compounds were collected by the U.S. Geological Survey from one voluntary survey of U.S. operations. Of the 18 operations canvassed, 61% responded, representing 63% of the magnesium compounds shipped and used (table 3). Data for the seven nonrespondents were estimated on the basis of prior-year consumption levels and other factors.

Two companies in the United States produced olivine—Unimin Corp. and Olivine Corp. Unimin operated two mines, one in North Carolina and one in Washington, and processing plants in Indiana, North Carolina, and Washington. Olivine operated one mine and one processing plant in Washington.

Fused magnesia was produced by two companies in the United States—Newminco Inc. with a plant in Midway, TN, and UCM Group plc of the United Kingdom, which operated a plant in Cherokee, AL, through its Muscle Shoals Minerals Inc. subsidiary.

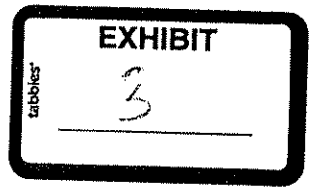
The largest magnesite production facilities in the world are in China, North Korea, and Russia. Together, these three countries account for two-thirds of the world magnesite production capacity. Japan and the United States account for more than one-half of the world's magnesium compounds production capacity from seawater or brines. Fused magnesia is produced in Australia, Brazil, Canada, China, Israel, Japan, the Republic of Korea, Mexico, Russia, the United Kingdom, and the United States. World production capacity is estimated to be about 650,000 metric tons per year (t/yr), including about 500,000 t/yr of capacity in China (Pearson, 2000).

Norway is the world's principal producer and supplier of olivine. Other producers include Australia, Italy, Japan, Mexico, Pakistan, Spain, and the United States. Rudi (2001) estimated that total world production of olivine averaged about 4 million metric tons per year (Mt/yr), with about 3.3 Mt/yr consumed in Europe.

In early 2002, Germany's RHI AG announced that it wanted to sell all the companies included under its subsidiary RHI Refractories Holding Co. because of increasing asbestos litigation. In February, RHI Refractories announced that three of its businesses, Global Industrial Technologies Inc., Harbison-Walker Refractories Co., and A.P. Green Refractories Co., filed for reorganization under Chapter 11 of the U.S. Bankruptcy Code. North American Refractories Co., the other member of RHI Refractories, had filed for Chapter 11 bankruptcy at the beginning of January (RHI Refractories Holding Co., 2002§). RHI Refractories changed its name to ANH Refractories Co. in August to establish an identity separate from that of RHI AG. At yearend, all subsidiaries continued to operate under Chapter 11.

At the beginning of 2003, Dow Chemical Co. announced that it would idle its Ludington, MI, brine production facility and would purchase the raw material from Martin Marietta Magnesia Specialties LLC. Dow was installing a 43-kilometer pipeline to feed the brine from Martin Marietta's Manistee, MI, plant to its plant. Dow has recovered calcium chloride and

[1]References that include a section mark (§) are found in the Internet References Cited section.



magnesium hydroxide from the brine pumped in Ludington for the past 60 years (Ludington Daily News, 2003a§). This change, however, has a significant impact on ANH Refractories' dead-burned magnesia plant that relies on Dow to supply the plant's magnesium chloride brine feed material. ANH Refractories would have to close the plant after Dow stops supplying brine unless another supplier is found. ANH Refractories employs 70 workers at the Ludington facility (Ludington Daily News, 2003b§).

Several other changes at U.S. magnesia producers were implemented in 2002. Martin Marietta closed its Pittsburgh, PA, magnesium hydroxide slurry plant to consolidate production at Manistee. Premier Chemicals LLC completed a $250,000 investment to retrofit an idled multiple hearth furnace to increase its magnesia production capacity in Florida by 25,000 t/yr. A plant upgrade, which was completed in 2001, allowed Rohm & Haas Co. to increase its production capacity for specialty grades of magnesium hydroxide to 25,000 t/yr in 2002 (Harris, 2002).

UCM Group announced that it would consolidate its fused magnesia operations in the United States. The company operated fused magnesia plants in Greeneville, TN, and Cherokee, AL, but neither was operating at full capacity. The company intended to move magnesia production from Greeneville to Cherokee and use the excess capacity at Greeneville to produce fused zirconia. UCM's total fused magnesia capacity in the United States and the United Kingdom was about 34,000 t/yr but dropped to 28,000 t/yr after the transfer of capacity from Greeneville (Industrial Minerals, 2002c).

Consumption

In 2002, chemical intermediates was the largest end use for caustic-calcined magnesia with 36% of the total. Environmental applications (water treatment and stack gas scrubbing, in descending order) was the second largest end use, with 34% of the total. The following categories, with the individual components in descending order of consumption in parentheses, were the other end-use sectors for caustic-calcined magnesia: agriculture (animal feed and fertilizers), 22%; construction (primarily oxychloride and oxysulfate cements), 5%; manufacturing (rubber, fuel additives, and electrical), 2%; pharmaceuticals and nutrition (sugar and medicine and pharmaceuticals), less than 1%; and unspecified uses, less than 1%.

Magnesium carbonate was used principally as a chemical intermediate, in medicines and pharmaceuticals, in rubber processing, and in cosmetics (uses are given in descending order of quantity). Magnesium hydroxide was used mainly for water treatment and in the chemical industries. Smaller applications for magnesium hydroxide were in medicine and pharmaceuticals, in the construction industry, and in rubber processing. Magnesium sulfate was used mostly for animal feed, pulp and paper, chemical, and pharmaceutical applications. Magnesium chloride was used mainly for ice control and in medicines and pharmaceuticals. Magnesium chloride brines were used principally for road dust and ice control and as a chemical intermediate.

Foundry uses remained the largest application for olivine in the United States, accounting for 78% of consumption of domestically produced material. Slag conditioning accounted for 11% of U.S. consumption; sandblasting and other abrasive uses, 7%; and refractory applications, 4%.

Prices

Most yearend 2002 prices for magnesium compounds quoted in Chemical Market Reporter and Industrial Minerals remained the same as those for 2001 (table 4). Prices for magnesium sulfate (epsom salts), anhydrous magnesium chloride, and foundry-grade olivine increased slightly.

Foreign Trade

In 2002, dead-burned magnesia exports from the United States increased by about 15% (table 5). Canada (75%) and Austria (8%) were the principal destinations. Caustic-calcined magnesia exports were 48% greater than those in 2001. France (52%), the Netherlands (15%), and Italy (14%) were the main destinations.

Imports of caustic-calcined and dead-burned magnesias rose in 2002. U.S. imports of dead-burned magnesia in 2002 were about 9% higher than those in 2001 (table 7). China (73%) and Australia (14%) continued to be the principal source countries. Imports of caustic-calcined magnesia were 14% higher than those in 2001. China (60%) and Canada (33%) were the primary sources.

Trade data for olivine are not available separately from the U.S. Census Bureau. The Journal of Commerce Port Import/Export Reporting Service (PIERS), however, provides data on material that travels by ship. U.S. exports of olivine in 2002 were 850 t, with 84% of the material shipped to Argentina. U.S. olivine imports totaled 97,800 t, a 77% increase from those in 2001. Norway was the source of almost all (99.9%) U.S. olivine imports.

World Review

Australia.—WestMag Ltd. delayed development of its Pilbara magnesia project because the Australian market for magnesia has not developed as rapidly as expected. WestMag had planned on marketing much of its product to Australia's lateritic nickel industry, but the expansion of existing lateritic nickel plants and the development of new deposits have been slower than originally projected. Because of market delays, WestMag has decided that instead of completing the scoping study, which had originally been scheduled to be finished by mid-2002, it would conserve the funds raised through a stock offering. WestMag was evaluating investments in other projects that would increase short-term shareholder value while waiting for the magnesia market to develop (Industrial Minerals, 2002d).

Australian Magnesium Corp. Ltd.'s 2001-02 annual report included an A$5.6 million writedown provision in the Flamemag joint-venture investment, which was expected to produce magnesium hydroxide for flame-retardant applications, because of the company's decision to focus all of its resources on the magnesium metal and magnesia businesses. By the end of December, QMC (Flamemag) Pty. Ltd. transferred all its shares in Flamemag International GIE to Compagnie Internationale

de Developpement Minier, and Flamemag International had transferred all the Flamemag patents and patent applications to QMC (Flamemag). As a result, the Flamemag Australia joint venture was terminated (Australian Magnesium Corp. Ltd., 2002§, 2003§).

Canada.—The Government of Quebec announced that it would invest in a bankable feasibility study for a mine at Globex Mining Enterprises Inc.'s Timmins magnesite-talc deposit. A scoping study, completed in 2001, indicated that a mine, mill, and smelter complex producing 90,000 t/yr of magnesium metal would be an appropriate scale for the project. Globex Mining reported that, based on previous drilling results, the property contains a large body (more than 100 million metric tons) of magnesite, talc, and quartz. The ore body is made up of about 54% magnesite, 27% talc, and 16% quartz, with 3% accessory iron oxides. Globex planned to begin the Can $9 million feasibility study after financing was complete (North American Minerals News, 2002).

China.—UCM formed a manufacturing and distribution arrangement with Yingkou Tianhu Magnesia Industries Co. Ltd. (YTMI), a fused magnesia producer in Liaoning Province. YTMI will produce electrical-grade fused magnesia to UCM's specifications and sell the entire output to UCM. Quantities produced under the agreement were confidential. This arrangement would increase UCM's customer base in China. In 2002, UCM operated fused magnesia plants in the United States and the United Kingdom with a total production capacity of 28,000 t/yr, and UCM is estimated to have supplied about 60% to 65% of the world market for electrical-grade fused magnesia (Industrial Minerals, 2002c).

South Africa.—Optimin SA, a South African industrial minerals firm, and Syferfontein Group jointly purchased the assets of Venmag (Pty.) Ltd. in early 2002. Venmag's assets consist of a magnesite mine and processing plant in Northern Province that has the capability to produce 9,000 t/yr of caustic-calcined magnesite and 50,000 t/yr of crude magnesite. The company's new name is Syferfontein Magnesite. Optimin, which also produces high-grade magnesia from a plant in Zimbabwe, began a feasibility study for production of dead-burned magnesia, magnesium chloride, and magnesium sulfate to supplement imported products. Imports of caustic-calcined magnesia represent about 20% of the market, which is primarily agriculture, water treatment, and cement applications. No dead-burned magnesia is produced in South Africa; the refractories manufacturers import the material that they require (Industrial Minerals, 2002b).

United Kingdom.—After filing for bankruptcy in January, Britmag Ltd. sold its nonrefractory assets in a management buyout to CJC Chemicals Ltd. CJC Chemicals was formed in March by former directors of Britmag. The new company will focus on its magnesia powder and magnesia solution products, which had been profitable previously. The company planned to introduce new products and reintroduced a 99%-magnesia product that had not been successfully produced within the past year. The magnesia slurry that had been used for the 99% product had been used instead as feed for low-value refractory products. Concentration on these low-valued products was cited as the principal reason for Britmag's bankruptcy declaration (Industrial Minerals 2002a).

Outlook

Because refractory applications are the largest use of magnesia, the health of the industries that use magnesia-base refractories is the most important determinant in the U.S. consumption of magnesia. The iron and steel industry is the principal consumer of magnesia refractories; magnesia refractory consumption generally follows iron and steel production (figure 1). In the early part of 2003, the American Iron and Steel Institute reported that U.S. steel production was higher when compared with 2002 production and that imports of steel mill products had decreased. If this trend continues, consumption of dead-burned magnesia is projected to increase in 2003.

The probable closure of ANH Refractories' plant in Michigan would leave Premier Chemicals and Martin Marietta as the only producers of dead-burned magnesia in the United States. This would provide additional opportunities for imports of magnesia to fulfill the U.S. demand. Since 1993, imports have provided more than one-half the U.S. consumption of dead-burned magnesia; this has increased to more than three-quarters in recent years (figure 2). China has become the largest import source, providing, on average, about 70% of the total dead-burned magnesia imports. With a projected increase in consumption and a decline in production, China is expected to continue to supply an even greater share of U.S. demand for dead-burned magnesia.

In the high-purity caustic-calcined magnesia market (greater than 97% magnesium oxide), producers reported that the plastics market is stable, the pharmaceutical and electrical steel markets are growing, the chemical market is continuing to follow the gross domestic product, and the rubber market has declined because of conditions in the automotive industry. The supply of high-grade magnesia has not changed much in recent years, and there is some overcapacity. Because of the customer-specific properties for each individual application, customers are reluctant to change suppliers once they have been qualified, so new suppliers entering the market are rare. In the low- to medium-grade caustic-calcined magnesia market, Chinese imports are affecting U.S. production. Material from China is beginning to be barged up the Mississippi River to major farming states to capture the agricultural magnesia market, which is considered by producers to show little growth (Harris, 2002). Because of the wide variety of applications for caustic-calcined magnesia, its markets are influenced by varying factors. Growth in one market is likely to be offset by a decline in consumption in another market, so U.S. consumption is expected to remain stable.

Industry sources predict that the market for magnesium hydroxide will continue to grow. Because of the sluggish U.S. economy, the market for magnesium hydroxide has shown slower growth in the past year than its typical rate of 3% to 4% per year. Both slurry for environmental applications and powder for flame-retardant applications have been in overcapacity, but the slurry overcapacity has been greater. Slurry for water treatment is estimated to grow at rate of 3% to 5% per year through 2006. Demand for magnesium hydroxide for flame-retardant applications has been steady and is expected to remain stable (Van Savage, 2002b).

Magnesium sulfate imports, particularly from Germany, have had an impact on the U.S. market. According to producers, these imports have prevented domestic plants from operating at full production capacity. Consumption growth for magnesium sulfate has been mixed, depending on the market. In the consumer sector—the personal care market and as a secondary nutrient for gardens and lawns—the use of magnesium sulfate in the form of epsom salt has been growing at a rate of about 6% per year. In recent years, the agricultural market, however, has been either flat or declining on an annual basis, mostly because of dry conditions in Florida, where the magnesium in sandy soils is depleted after significant rains. Agricultural use represents about 15% of total magnesium sulfate demand and consists mainly of feed supplements to prevent grass tetany in farm animals (Van Savage, 2002a). Growth or decline in this market most likely will depend on weather conditions.

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TABLE 1
SALIENT MAGNESIUM COMPOUND STATISTICS[1]

(Thousand metric tons and thousand dollars)

	1998	1999	2000	2001	2002
United States:					
Caustic-calcined and specified magnesias:[2]					
Shipped by producers:[3]					
Quantity	177	179	172	136	127
Value	$76,700	$77,000	$46,000	$43,300	$38,100
Exports[4]	5	3	12	4	6
Imports for consumption[4]	127	123	136	130	148
Refractory magnesia:					
Shipped by producers:[3]					
Quantity	215	216	196	213	123
Value	$75,000	$75,300	$68,100	$71,300	$37,800
Exports	63	67	60	63	73
Imports for consumption	427	392	501	363	394
World, production of magnesite	11,400	9,830 r	12,700 r	11,200 r	11,200 e

eEstimated. rRevised.

[1]Data are rounded to no more than three significant digits.

[2]Excludes caustic-calcined magnesia used in the production of refractory magnesia.

[3]Includes magnesia used by producers.

[4]Caustic-calcined magnesia only.

TABLE 2
U.S. MAGNESIUM COMPOUND PRODUCERS, BY RAW MATERIAL SOURCE, LOCATION, AND PRODUCTION CAPACITY, IN 2002

Raw material source and producing company	Location	Capacity (metric tons of MgO equivalent)[1]	Products
Brucite, Applied Chemical Magnesias Corp.	Van Horn, TX, and Bullhead City, AZ	25,000	Magnesium hydroxide.
Magnesite, Premier Chemicals LLC	Gabbs, NV	140,000	Caustic-calcined and dead-burned magnesia.
Lake brines:			
Great Salt Lake Minerals Corp.	Ogden, UT	106,000	Magnesium chloride and magnesium chloride brines.
Reilly Industries Inc.	Wendover, UT	45,000	Magnesium chloride brines.
Well brines:			
The Dow Chemical Co.[2]	Ludington, MI	214,000	Magnesium hydroxide.
Martin Marietta Magnesia Specialties LLC[3]	Manistee, MI	297,000	Caustic-calcined and dead-burned magnesia.
Rohm and Haas Co.	do.	25,000	Magnesium carbonate, magnesium hydroxide, and caustic-calcined magnesia.
Seawater:			
Premier Chemicals LLC	Port St. Joe, FL	75,000	Caustic-calcined magnesia and magnesium hydroxide.
SPI Pharma Inc.	Lewes, DE	5,000	Magnesium hydroxide.
Western Salt Co.	Chula Vista, CA	3,000	Magnesium chloride brines.
Total		935,000	

[1]Data are rounded to no more than three significant digits; may not add to total shown.

[2]Most of Dow's production was shipped to ANH Refractories Co. in Ludington, MI, where it was converted to dead-burned magnesia at a 200,000-metric-ton-per-year-capacity plant.

[3]In addition to its Michigan plant, Martin Marietta owned a 15,000-metric-ton-per-year-capacity magnesium hydroxide plant in Lenoir City, TN, which used imported magnesite as a raw material.

TABLE 3
U.S. MAGNESIUM COMPOUNDS SHIPPED AND USED[1]

	2001		2002	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesias[2]	136,000	$43,300	127,000	$38,100
Magnesium hydroxide [100% $Mg(OH)_2$][1]	268,000	100,000	218,000	86,900
Magnesium sulfate, anhydrous and hydrous	38,100	12,000	38,000	12,400
Precipitated magnesium carbonate[2]	1,750	4,170	1,710	4,130
Refractory magnesia	213,000	71,300	123,000	37,800

[1]Data are rounded to no more than three significant digits.
[2]Excludes material produced as an intermediate step in the manufacture of other magnesium compounds.

TABLE 4
YEAREND MAGNESIUM COMPOUND PRICES

Material		2001	2002
Magnesia, dead-burned	per short ton	$388	$388
Magnesia, synthetic, technical, 98% MgO	do.	488	488
Magnesium chloride, hydrous, 99%, flake	do.	290	290
Magnesium chloride, anhydrous, 92%, flake or pebble	per pound	0.1275-0.15	0.145
Magnesium hydroxide, powder, technical	do.	0.45	0.45
Magnesium hydroxide slurry, technical, 100% $Mg(OH)_2$	do.	210	210
Magnesium sulfate, technical (epsom salts)	do.	0.18-0.195	0.175-0.21
Olivine, aggregate, free on board plant or mine	per metric ton	50-78	50-78
Olivine, foundry grade, free on board plant or mine	do.	60-110	62-109

Sources: Chemical Market Reporter and Industrial Minerals.

TABLE 5
U.S. EXPORTS OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY[1]

	2001		2002	
Material and country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined magnesia:				
Brazil	367	$527	390	$419
France	1,570	1,000	2,850	1,660
Germany	332	217	327	193
Italy	99	59	763	406
Japan	536	569	--	--
Netherlands	476	321	856	492
Other	374 r	259 r	347	223
Total	3,750	2,960	5,540	3,390
Dead-burned and fused magnesia:				
Austria	7,270	1,780	6,000	1,460
Canada	40,600	12,300	54,400	15,800
Chile	1,500	504	2,060	640
Germany	5,310	1,850	4,410	1,200
Japan	2,270	700	57	42
Korea, Republic of	683	582	1,040	513
Mexico	936	448	1,240	648
Netherlands	717	352	749	470
Vietnam	1,120	322	--	--
Other	2,780 r	2,370 r	2,730	2,190
Total	63,100	21,200	72,700	22,900

See footnotes at end of table.

TABLE 5--Continued
U.S. EXPORTS OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY[1]

Material and country	2001 Quantity (metric tons)	2001 Value (thousands)	2002 Quantity (metric tons)	2002 Value (thousands)
Other magnesia:				
Canada	10,500	$3,460	6,880	$2,510
Colombia	1,550	585	4,240	972
Germany	1,470	11,400	304	518
Hong Kong	1,100	1,400	866	1,050
Indonesia	1,730	1,090	1,180	659
Japan	1,870	1,610	5,750	4,980
Mexico	11,600	6,930	7,100	5,240
Taiwan	2,150	1,280	1,020	640
Venezuela	980	363	--	--
Other	3,730 r	15,900 r	4,520	5,480
Total	36,600	44,100	31,900	22,000
Crude magnesite:				
Argentina	1,040	111	762	81
Brazil	2,400	256	--	--
Canada	2,950	406	2,260	335
France	1,470	157	2,820	302
Korea, Republic of	1,100	151	--	--
Spain	2,870	332	--	--
United Kingdom	1,070	121	2,250	240
Venezuela	2,520	347	8,760	1,080
Other	3,380 r	416 r	2,290	264
Total	18,800	2,300	19,100	2,310

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 6
U.S. EXPORTS OF MAGNESIUM COMPOUNDS[1]

Material	2001 Quantity (metric tons)	2001 Value (thousands)	2002 Quantity (metric tons)	2002 Value (thousands)	Principal destinations, 2002
Magnesium chloride, anhydrous and other	3,630	$5,080	4,580	$2,340	Canada, 90%.
Magnesium hydroxide and peroxide	20,800	9,630	14,500	11,000	Canada, 61%; Germany, 14%.
Magnesium sulfate, natural kieserite and epsom salts	406	223	3,350	449	Canada, 81%; Panama, 16%.
Magnesium sulfate, other	6,360	3,860	7,450	3,610	Canada, 82%.

[1]Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY[1]

Material and country	2001 Quantity (metric tons)	2001 Value (thousands)	2002 Quantity (metric tons)	2002 Value (thousands)
Caustic-calcined magnesia:				
Canada	42,500	$8,000	49,200	$8,850
China	77,400	9,230	88,700	9,920
Greece	5,200	1,340	4,240	1,090
Other	4,780	4,830	5,400	4,530
Total	130,000	23,400	148,000	24,400
Dead-burned and fused magnesia:				
Australia	55,600	11,000	55,700	11,400
Austria	14,000	5,520	13,100	5,380
Brazil	9,500	994	--	--
China	245,000	36,400	286,000	40,500
Greece	--	--	4,630	1,790
Hong Kong	11,900	1,480	17,800	2,060
Israel	11,700	7,280	6,830	5,230
Other	15,400	4,570	9,880	3,700
Total	363,000	67,200	394,000	70,100
Other magnesia:				
Canada	3,160	775	1,390	369
China	453	117	3,320	1,320
Israel	2,410	5,280	1,910	4,830
Japan	1,670	3,220	1,810	3,280
Mexico	6,660	2,420	5,830	1,870
Slovakia	1,640	738	2,770	1,180
Other	1,170 r	908 r	570	757
Total	17,200	13,400	17,600	13,600
Crude magnesite:				
China	4,650	438	5,600	428
Israel	6	10	709	150
Japan	2,440	545	3,780	813
United Kingdom	3,210	690	76	57
Other	1,180	262	1,420	289
Total	11,500	1,950	11,600	1,740

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM COMPOUNDS[1]

	2001 Quantity (metric tons)	2001 Value (thousands)	2002 Quantity (metric tons)	2002 Value (thousands)	Principal sources, 2002
Magnesium chloride, anhydrous and other	62,000	$8,840	20,100	$4,930	Israel, 90%.
Magnesium hydroxide and peroxide	6,930	10,500	3,930	6,000	Netherlands, 30%; Austria, 20%.
Magnesium sulfate, natural epsom salts	77	20	65	29	Germany, 56%; China, 28%.
Magnesium sulfate, natural kieserite	22,500	640	13,300	815	Germany, 100%.
Magnesium sulfate, other	36,900	8,430	30,900	5,830	Germany, 53%; Canada, 40%.

[1]Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 9
WORLD MAGNESIUM COMPOUNDS ANNUAL PRODUCTION CAPACITY, DECEMBER 31, 2002[1, 2]

(Thousand metric tons of MgO equivalent)

Country	Raw material: Magnesite: Caustic-calcined	Raw material: Magnesite: Dead-burned	Raw material: Seawater or brines: Caustic-calcined	Raw material: Seawater or brines: Dead-burned	Total
North America:					
Canada	150	--	--	--	150
Mexico	--	--	15	95	110
United States	NA	NA	NA	NA	935 [3]
Total	150	NA	15	95	1,200
South America, Brazil	80	291	--	--	371
Europe:					
Austria	25	250	--	--	275
France	--	--	30	--	30
Greece	120	100	--	--	220
Ireland	--	--	--	90	90
Italy	25	--	5	70	100
Netherlands	--	--	8	150	158
Poland	--	10	--	--	10
Russia	100	2,670	--	--	2,770
Serbia and Montenegro	40	200	--	--	240
Slovakia	--	330	--	--	330
Spain	150	100	--	--	250
Turkey	20	309	--	--	329
Ukraine	--	120	20	80	220
United Kingdom	--	--	70	80	150
Total	480	4,090	133	470	5,170
Africa:					
South Africa	12	--	--	--	12
Zimbabwe	20	--	--	--	20
Total	32	--	--	--	32
Asia:					
China	200	2,480	--	10	2,690
India	25	261	--	--	286
Iran	--	30	--	--	30
Israel	--	--	10	60	70
Japan	--	--	50	250	300
Korea, North	--	500	--	--	500
Korea, Republic of	--	--	--	50	50
Total	225	3,270	60	370	3,920
Oceania, Australia	48	150	--	--	198
Grand total	1,020	7,800	208	935	10,900

NA Not available. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes capacity at operating plants, as well as at plants on standby basis.

[3]Includes capacity for production of magnesium chloride, magnesium chloride brines, magnesium carbonate, magnesium hydroxide, and caustic-calcined and dead-burned magnesias.

TABLE 10
MAGNESITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country	1998	1999	2000	2001	2002[e]
Australia	360,115	280,505	349,783	605,314 [r]	484,498 [3]
Austria, crude	723,000	749,000	726,000	700,000 [e]	700,000
Brazil, beneficiated[4]	308,300	259,834	279,876	265,749 [r]	270,000
Canada[e, 5]	180,000	180,000	180,000	180,000	180,000 [p]
China[e]	2,400,000	2,450,000	4,070,000 [r]	3,580,000 [r]	3,700,000
Colombia[e]	10,500	10,500	10,500	10,500	10,500
Greece, crude[e]	650,000	495,144 [3]	500,000	500,000	500,000
India	355,033	360,080	365,080	370,000 [e]	380,000
Iran[6]	109,597	141,081	141,000 [e]	143,000 [r, e]	140,000
Korea, North[e]	1,500,000	1,000,000	1,000,000	1,000,000	1,000,000
Mexico	274	308	335	350	350
Pakistan	3,157	2,175	4,192	4,200 [e]	4,000
Philippines[e]	-- [r]	-- [r]	-- [r]	-- [r]	--
Poland, concentrate	33,700 [r]	38,800 [r]	26,100 [r]	22,200 [r]	25,000
Russia[e]	851,845 [3]	900,000	1,000,000	1,000,000	1,000,000
Serbia and Montenegro, crude	81,000	31,000	41,000 [r]	36,000	35,000
Slovakia, concentrate	877,840	918,000	1,000,000 [r]	447,000 [r]	500,000
South Africa	74,300	73,900	63,000 [r]	33,900 [r]	40,000
Spain, calcined	201,000	211,000	266,000	260,000 [e]	250,000
Turkey, run-of-mine	2,703,343	1,724,744	2,672,089	2,000,000 [e]	2,000,000
United States	W	W	W	W	W [3]
Zimbabwe	4,321	5,356	4,029 [r]	2,439 [r]	2,366 [3]
Total	11,400,000	9,830,000 [r]	12,700,000 [r]	11,200,000 [r]	11,200,000

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Figures represent crude salable magnesite. In addition to the countries listed, Bulgaria produced magnesite, but output is not reported quantitatively; and available information is inadequate for formulation of reliable estimates of output levels. Table includes data available through May 20, 2003.

[3]Reported figure.

[4]Series reflect output of marketable concentrates. Production of crude ore was as follows, in metric tons: 1998--1,109,351; 1999--868,604; 2000--1,006,654; 2001--1,079,207 (revised); and 2002--1,100,000 (estimated).

[5]Magnesitic dolomite and brucite. Figures are estimated on the basis of reported tonnage dollar value.

[6]Year beginning March 21 of that stated.

FIGURE 1
U.S. STEEL PRODUCTION AND DEAD-BURNED MAGNESIA CONSUMPTION

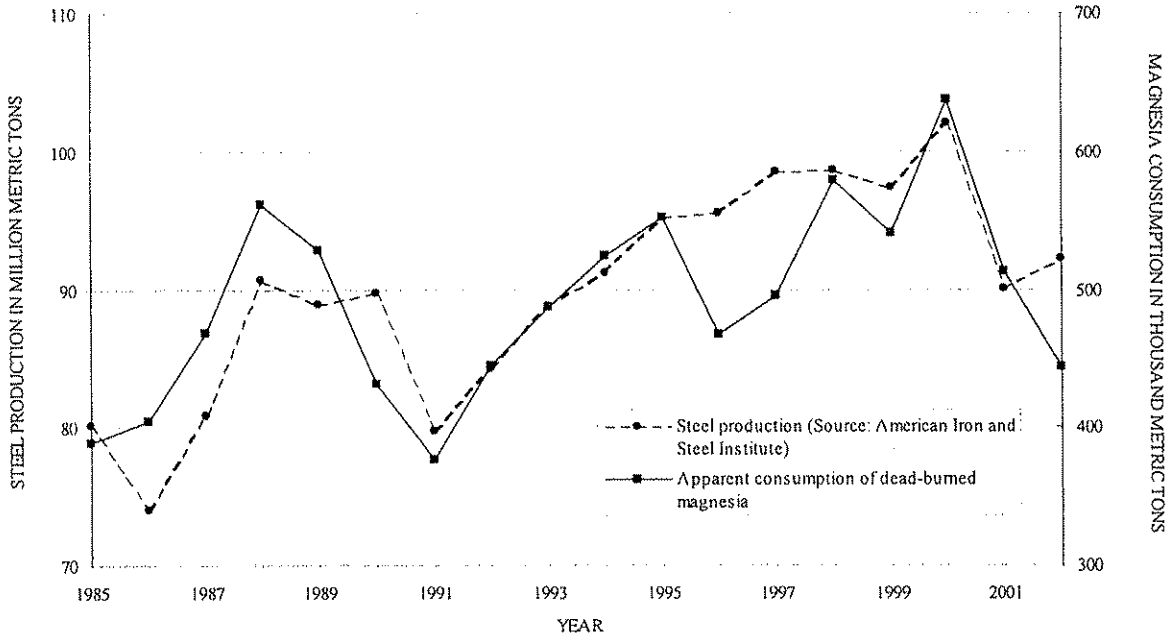
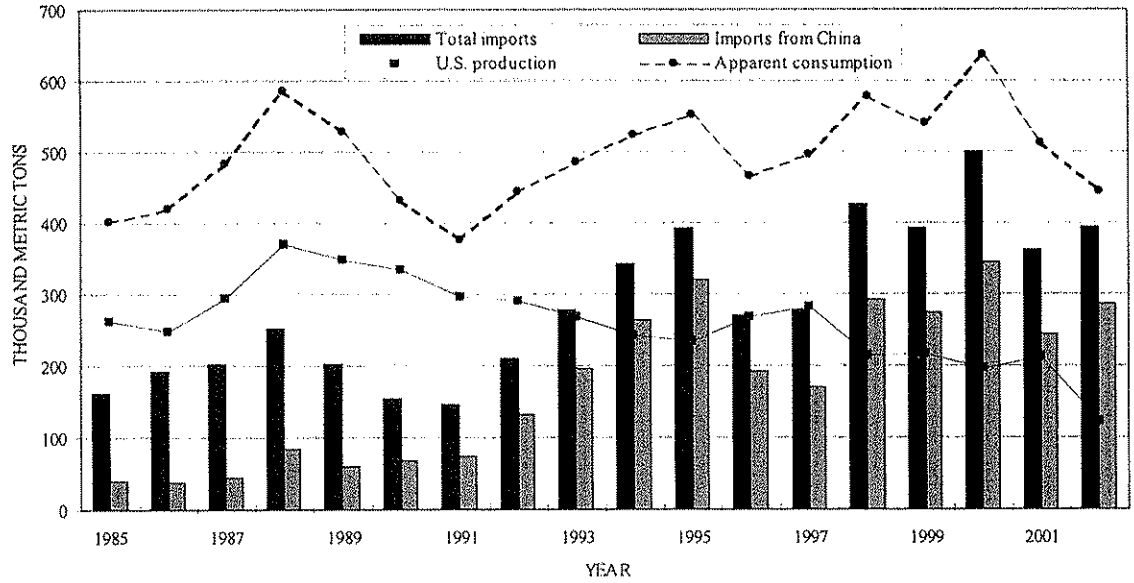


FIGURE 2
U.S. DEAD-BURNED MAGNESIA STATISTICS



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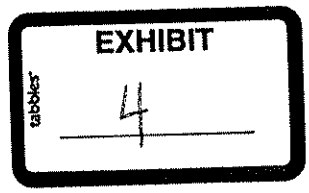
MAGNESIUM COMPOUNDS [ADVANCE RELEASE]



U.S. Department of the Interior
U.S. Geological Survey

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MAGNESIUM COMPOUNDS

By Deborah A. Kramer

Domestic survey data and tables were prepared by Kelly K. Hermanson, statistical assistant, and the world production table was prepared by Lisa D. Miller, international data coordinator.

Domestic production of caustic-calcined magnesia and dead-burned (refractory) magnesia in 2007 declined from that in 2006, and imports continued to account for most of the U.S. consumption of magnesia. Consumption of refractory magnesia was about 6% less than that in 2006. Caustic-calcined (and other) magnesia consumption decreased by 11%, with imports accounting for about 52% of total U.S. consumption.

About 41% of U.S. magnesium compounds production came from seawater and well and lake brines. The remainder was recovered from brucite, dolomite, magnesite, and olivine. About 60% of the total consumption of magnesium compounds was for refractory applications. The remaining 40% was used in agricultural, chemical, environmental, and other applications. China remained the dominant supplier of imports for caustic-calcined and refractory (dead-burned and fused) magnesias, with 87% and 83%, respectively, of the totals.

Production

U.S. shipments of caustic-calcined magnesia declined by 6% from those in 2006, and refractory magnesia shipments decreased as well (table 3). Magnesium hydroxide shipments remained at the same level as those in 2006.

Data for magnesium compounds were collected by the U.S. Geological Survey from one voluntary survey of U.S. operations. Of the 16 operations canvassed, 94% responded, representing 99% of the magnesium compounds shipped and used, including data for some compounds that were not reportable in table 3. Data for the single nonrespondent were estimated on the basis of prior-year production levels.

The largest capacity magnesite processing facilities in the world are in China, North Korea, and Russia. Together, these three countries accounted for two-thirds of the world magnesite production capacity. Japan and the United States accounted for about one-half of the world's magnesium compounds production capacity from seawater or brines. Fused magnesia was produced in Australia, Brazil, China, Israel, Japan, the Republic of Korea, Mexico, Russia, the United Kingdom, and the United States. World production capacity was estimated to be about 560,000 metric tons per year (t/yr), including about 372,000 t/yr of capacity in China (Schroeder, 2006). Fused magnesia was produced by one company in the United States—UCM Group PLC of the United Kingdom, which operated a plant in Cherokee, AL, through its Muscle Shoals Minerals Inc. subsidiary.

Norway is the world's principal producer and supplier of olivine. Other producers include Australia, Austria, Brazil, China, Denmark (Greenland), Greece, Italy, Japan, the Republic of Korea, Mexico, Spain, Taiwan, Turkey, and the United States. Rudi (2001) estimated that total world production of olivine averaged about 4 million metric tons per year (Mt/yr), with about 3.3 Mt/yr consumed in Europe. An additional 4 Mt/yr of dunite and serpentinite, which are often commercially called olivine, is produced. Two companies in the United States produced olivine—Olivine Corp. and Unimin Corp. Olivine operated one mine and one processing plant in Washington. Unimin operated a mine in North Carolina and processing plants in Indiana and North Carolina.

Compass Minerals International Inc. (through its Great Salt Lake Minerals subsidiary) planned to spend $25 million to upgrade its processing plant and modify its solar evaporation ponds near the Great Salt Lake in Utah. The 3-year expansion, which was scheduled to begin in 2008, was expected to increase the company's sulfate of potash production by 20%, and the company's magnesium chloride brine production likely would increase as well. The State of Utah agreed to lease 23,000 additional acres to the firm to build new solar evaporation ponds. The company was required to get construction permits from the U.S. Army Corps of Engineers to build these additional ponds (Green Markets, 2007).

Consumption

In 2007, environmental applications (water treatment and stack-gas scrubbing, in descending order) were the largest tonnage end use for caustic-calcined magnesia, with 58% of the total. The following categories, with the individual components in descending order of consumption in parentheses, were the other end-use sectors for caustic-calcined magnesia: agriculture (animal feed and fertilizers), 19%; chemical, 18%; construction (primarily oxychloride and oxysulfate cements), 3%; manufacturing (fluxes, rubber, and electrical), 2%; pharmaceuticals and nutrition and unspecified uses, each less than 1%.

Magnesium hydroxide was used mainly for water treatment, as a chemical intermediate, and in medicines and pharmaceuticals (uses are given in descending order of quantity). Smaller applications for magnesium hydroxide were in fertilizer, in rubber processing, and in the construction industry. Magnesium sulfate was used mostly for chemical, pulp and paper, fertilizer, rubber, pharmaceutical, water treatment, cosmetics, and construction applications (in descending order of quantity). Magnesium chloride was used mainly for ice control. Magnesium chloride brines were used for road dust and ice control.

Prices

Price data for magnesium compounds were not published in 2007. Because of the wide range of grades and applications of

caustic-calcined and dead-burned magnesias, average values derived from U.S. production or export data would not be representative of a price for any specific product.

Foreign Trade

In 2007, dead-burned magnesia exports were 12% higher than those in 2006 (table 5). Canada (79%) was the principal destination. Caustic-calcined magnesia exports were 22% lower than those in 2006. The Netherlands (35%) and France (32%) were the main destinations (table 4).

Imports of caustic-calcined magnesia were 18% lower than those in 2006, and imports of dead-burned magnesia were slightly higher than those in 2006. For both types of magnesia, China was the principal source country (table 6).

Trade data for olivine are not available separately from the U.S. Census Bureau. The Journal of Commerce Port Import/Export Reporting Service (PIERS), however, provides data on material that travels by ship. U.S. exports of olivine were 17 metric tons (t) in 2007, almost all of which was exported to Taiwan. U.S. olivine imports were 95,200 t, 44% less than those in 2006. Norway, with 99% of the total, was the principal source of olivine imports to the United States.

World Review

Brazil.—A private equity group, GP Investments Ltd., purchased Magnesita S.A., the leading magnesite producer in Brazil. The company's magnesia plant had the capacity to produce 345,000 t/yr of dead-burned magnesia and 70,000 t/yr of caustic-calcined magnesia. Most of the dead-burned magnesia was consumed internally to produce magnesia-base refractories, about 70% of which was used by Brazil's steel industry. From 2003 through 2006, Magnesita had invested $100 million to increase production, improve quality, and introduce new refractory products for the steel industry. The equity firm planned to expand the business further, although no specific details were available (O'Driscoll, 2007a).

Canada.—Baymag Inc. stopped producing fused magnesia in 2006. The company's parent firm (German-based Refratechnik GmbH) had invested in fused magnesia plants in China, so production from Baymag's Alberta plant was no longer needed (Simandl, 2007).

China.—Industry sources reported that significant quantities of dead-burned magnesia have been smuggled out of China to the Republic of Korea without payment of export license fees and duties; the material then was exported to Europe and the United States. This material reportedly was being offered at prices that were $25 to $40 per metric ton lower than comparable export prices from China. In addition, China instituted a 5% export tax on magnesia on July 1, further exacerbating the smuggling problem (O'Driscoll, 2007b).

Jordan.—Jordan Magnesia Co. Ltd. (Jormag) (a subsidiary of Arab Potash Co.) was engaged in International Chamber of Commerce arbitration proceedings with its construction contractor AMEC Americas Ltd. concerning the construction of its recently built magnesia plant. After the company and the contractor reached a settlement agreement, Jormag received $41.0 million in May. The company planned to use $5 million of the settlement to pay Social Security and other third-party liabilities and retain the balance (Arab Potash Co., 2007). Although the plant had been completed in 2003, it ran for only about 1 year because of technical problems. The plant has been idle since yearend 2004.

Russia.—Nikochem LLC, which began producing magnesium chloride from bischofite in Volgograd, Russia, at the end of 2006, announced that it would construct a plant to produce high-purity magnesium oxide and magnesium hydroxide. The new production, which was scheduled to start in 2009, would come from thermal decomposition of bischofite. When completed, the new plant would be capable of producing 15,000 t/yr of magnesium oxide and 20,000 t/yr of magnesium hydroxide (Industrial Minerals, 2007a).

Serbia.—In March, the Kosovo Trust Agency received final bids for the area's two magnesite mines, XIM Strezoc Magnesite Mine and Goleshi Magnesite Mine. Although the bidders were identified only by number, the successful bidder for the XIM Strezoc Mine was reported to be the Croatian company Iming d.o.o., with a bid of €730,000 and a guaranteed investment of €14,300,000. The purchaser of the Goleshi Magnesite Mine was not identified, but had a winning bid of €810,000 and a guaranteed investment of €16,200,000 (Kosovo Trust Agency, 2007). Although both operations had produced dead-burned and caustic-calcined magnesia prior to the Balkan conflict in the early 1990s, neither had produced since the early 2000s.

Turkey.—ŞETAT Madencilik Gıda Sanayi ve Ticaret A.Ş. (Setat Mining) began producing magnesite in 2007. The company began producing at a 60,000-t/yr rate from deposits in the Bursa and Orhancli regions. Setat Mining had begun producing olivine in 2005 from the Orhaneli deposit and has traditionally produced chromite from the same region (Industrial Minerals, 2007b).

Outlook

According to the International Iron and Steel Institute (2008), world crude steel output reached 1.34 billion metric tons in 2007, an increase of 7.5% from that in 2006. This total represents the highest level of crude steel output in history, and it is the fifth consecutive year that world crude steel production grew by more than 7%. China's steel production in 2007 reached 489 Mt, a 15.7% increase from that in 2006. Although a 15.7% growth rate is significant, it was lower than growth rates from 2004 to 2006. Excluding China, world crude steel production from 2006 to 2007 increased by only 3.3%. China represented more than 36% of total world production in 2007. A sustained increase in steel production in China could lead to more internal consumption of magnesia-based refractories, which could result in less magnesia available for the export market. China, however, has significant magnesite resources, particularly in Liaoning Province, and most likely would continue to develop the magnesite deposits to satisfy domestic and export markets.

Most caustic-calcined magnesia markets are fairly mature, but use of caustic-calcined magnesia and magnesium hydroxide for environmental applications was expected to continue to grow. Because of its superior properties, magnesium hydroxide

was expected to continue to replace such materials as lime and caustic soda in some environmental applications. In addition, the use of magnesium hydroxide as a flame retardant material in specialized wire and cable applications could present an area for growth.

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TABLE 1

SALIENT MAGNESIUM COMPOUND STATISTICS[1]

(Thousand metric tons and thousand dollars)

	2003	2004	2005	2006	2007
United States:					
Caustic-calcined and specified magnesias:[2]					
Shipped by producers:[3]					
Quantity	154	132	137	133 r	125
Value	61,000	55,400	60,300	60,300 r	41,100
Exports[4]	4	4	5	6	4
Imports for consumption[4]	150	157	152	163	134
Refractory magnesia:					
Shipped by producers:[3]					
Quantity	84	W	W	W	W
Value	23,500	W	W	W	W
Exports	56	30	25	20	22
Imports for consumption	379	418	478	433	437
World, production of magnesite	14,100 r	16,500 r	15,100 r	15,000 r	15,200 e

eEstimated. rRevised. W Withheld to avoid disclosing company proprietary data.

[1]Data are rounded to no more than three significant digits.

[2]Excludes caustic-calcined magnesia used in the production of refractory magnesia.

[3]Includes magnesia used by producers.

[4]Caustic-calcined magnesia only.

TABLE 2

U.S. MAGNESIUM COMPOUND PRODUCERS, BY RAW MATERIAL SOURCE, LOCATION, AND PRODUCTION CAPACITY, IN 2007[1]

(Metric tons, MgO equivalent)

Raw material source and producing company	Location	Capacity	Products
Brucite, Applied Chemical Magnesias Corp.	Van Horn, TX, and Bullhead City, AZ	25,000	Magnesium hydroxide.
Magnesite, Premier Chemicals LLC	Gabbs, NV	140,000	Caustic-calcined magnesia.
Lake brines:			
Great Salt Lake Minerals Corp.	Ogden, UT	185,000	Magnesium chloride and magnesium chloride brines.
Intrepid Wendover-Potash LLC	Wendover, UT	45,000	Magnesium chloride brines.
Well brines:			
Martin Marietta Magnesia Specialties LLC[2]	Manistee, MI	314,000	Caustic-calcined magnesia, dead-burned magnesia, and magnesium hydroxide.
Rohm and Haas Co.	do.	25,000	Caustic-calcined magnesia and magnesium hydroxide.
Seawater:			
Premier Chemicals LLC	Port St. Joe, FL	107,000	Do.
South Bay Salt Works	Chula Vista, CA	3,000	Magnesium chloride brines.
SPI Pharma Inc.	Lewes, DE	5,000	Magnesium hydroxide.
Total		849,000	

do. Ditto.

[1]Data are rounded to no more than three significant digits; may not add to total shown.

[2]In addition to its Michigan plant, Martin Marietta owned a 15,000-metric-ton-per-year-capacity magnesium hydroxide plant in Lenoir City, TN, which used imported magnesite as a raw material.

TABLE 3

U.S. MAGNESIUM COMPOUNDS SHIPPED AND USED[1]

	2006		2007	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesias[2]	133,000 r	$60,300 r	125,000	$41,100
Magnesium hydroxide [100% $Mg(OH)_2$][2]	173,000 r	84,600 r	173,000	81,000
Magnesium sulfate, anhydrous and hydrous	45,500 r	12,800 r	48,900	13,400
Refractory magnesia	W	W	W	W

rRevised. W Withheld to avoid disclosing company proprietary data.

[1]Data are rounded to no more than three significant digits.

[2]Excludes material produced as an intermediate step in the manufacture of other magnesium compounds.

TABLE 4

U.S. EXPORTS OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY[1]

Material and country	2006 Quantity (metric tons)	2006 Value (thousands)	2007 Quantity (metric tons)	2007 Value (thousands)
Caustic-calcined magnesia:				
France	1,810	$1,080	1,430	$871
Germany	569	345	721	449
Netherlands	1,500	915	1,560	985
Venezuela	1,480	615	150	68
Other	319	253	563	406
Total	5,690	3,210	4,420	2,780
Dead-burned and fused magnesia:				
Brazil	219	190	54	41
Canada	16,200	7,630	17,700	7,990
France	61	50	238	214
Germany	721	550	605	492
Mexico	549	832	1,660	1,120
Netherlands	52	46	371	810
Poland	319	236	119	104
Taiwan	242	162	258	173
United Kingdom	252	238	240	227
Venezuela	52	34	261	132
Other	1,360 r	1,390 r	866	748
Total	20,000	11,400	22,400	12,000
Other magnesia:				
Brazil	805	1,020	1,490	1,590
Canada	5,820	3,350	3,210	2,630
France	473	338	402	406
Germany	2,280	1,680	345	269
Hong Kong	865	916	733	745
Korea, Republic of	534	806	1,070	1,230
Mexico	2,010	2,130	1,980	2,220
Taiwan	856	677	1,100	974
Turkey	672	733	867	938
United Kingdom	888	1,170	259	394
Venezuela	1,110	766	461	479
Other	4,880 r	5,290 r	3,630	4,620
Total	21,200	18,900	15,500	16,500
Crude magnesite:				
Argentina	442	47	1,130	129
Canada	2,780	369	2,770	382
China	--	--	1,390	268
France	983	105	2,460	281
Germany	1,740	186	591	72
Mexico	385	45	761	126
Sweden	1,040	139	--	--
Other	1,650 r	185 r	2,570	294
Total	9,020	1,080	11,700	1,550

rRevised. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 5
U.S. EXPORTS OF MAGNESIUM COMPOUNDS[1]

Material	2006 Quantity (metric tons)	2006 Value (thousands)	2007 Quantity (metric tons)	2007 Value (thousands)	Principal destinations, 2007
Magnesium chloride, anhydrous and other	7,650	$5,470	7,690	$5,480	Canada, 86%.
Magnesium hydroxide and peroxide	14,200	12,000	15,200	11,800	Canada, 55%; United Kingdom, 13%; Mexico, 11%.
Magnesium sulfate, natural kieserite and epsom salts	303	208	733	474	Canada, 86%.
Magnesium sulfate, other	9,600	4,260	10,500	5,100	Canada, 85%; Saudi Arabia, 10%.

[1]Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 6
U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY[1]

Material and country	2006 Quantity (metric tons)	2006 Value (thousands)	2007 Quantity (metric tons)	2007 Value (thousands)
Caustic-calcined magnesia:				
Canada	18,700	$4,260	15,700	$4,580
China	127,000	16,000	117,000	14,900
Greece	3,000	824	--	--
Hong Kong	12,600	2,160	--	--
Turkey	936	387	1,220	530
Other	190 r	273 r	23	57
Total	163,000	23,900	134,000	20,100
Dead-burned and fused magnesia:				
Australia	20,000	6,940	16,800	5,800
Austria	30,500	17,800	32,700	18,200
China	360,000	67,300	364,000	84,100
Greece	6,600	1,720	13,200	4,420
Israel	2,410	4,540	2,310	4,430
Japan	8,340	6,870	3,010	5,320
Korea, Republic of	1,140	587	--	--
Mexico	3,240	1,570	2,820	1,310
Other	1,070	521	1,860	1,120
Total	433,000	108,000	437,000	125,000
Other magnesia:				
Canada	1,040	294	2,780	933
China	1,920	761	4,610	1,740
Israel	261	443	572	872
Japan	1,190	2,360	940	1,960
Mexico	11,800	5,480	9,910	4,790
Slovakia	1,650	478	1,390	386
Other	1,230	1,280	694	817
Total	19,000	11,100	20,900	11,500
Crude magnesite:				
Brazil	759	188	575	238
China	7,900	996	4,070	652
Israel	2,820	588	2,120	619
Japan	2,790	579	1,960	629
Other	893	196	283	82
Total	15,200	2,550	9,000	2,220

rRevised. -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM COMPOUNDS[1]

	2006		2007		
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Principal sources, 2007
Magnesium chloride, anhydrous and other	64,400	$12,100	49,100	$10,100	Israel, 64%; Netherlands, 29%.
Magnesium hydroxide and peroxide	10,300	17,100	8,630	14,800	Mexico, 32%; Israel, 28%; Austria, 16%.
Magnesium sulfate, natural epsom salts	1,150	268	465	195	China, 73%; India, 22%.
Magnesium sulfate, natural kieserite	8,920	373	5,830	334	Germany, 100%.
Magnesium sulfate, other	22,200	5,980	28,300	8,390	Germany, 55%; Mexico, 18%; China, 17%.

[1]Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 8
WORLD MAGNESIUM COMPOUNDS ANNUAL PRODUCTION CAPACITY, DECEMBER 31, 2007[1,2]

(Thousand metric tons, MgO equivalent)

	Raw material				
	Magnesite		Seawater or brines		
Country	Caustic-calcined	Dead-burned	Caustic-calcined	Dead-burned	Total
Australia	78	110	--	--	188
Austria	197	268	--	--	465
Brazil	83	351	--	--	434
Canada	50	--	--	--	50
China	275	2,940	--	10	3,230
France	--	--	30	--	30
Greece	120	100	--	--	220
India	20	296	--	--	316
Iran	--	30	--	--	30
Ireland	--	--	--	90	90
Israel	--	--	10	60	70
Italy	25	--	--	--	25
Japan	--	--	50	250	300
Jordan	--	--	10	50	60
Korea, North	--	1,100	--	--	1,100
Korea, Republic of	--	--	--	40	40
Mexico	--	--	15	95	110
Netherlands	--	--	10	150	160
Poland	--	10	--	--	10
Russia	100	2,400	--	--	2,500
Serbia	40	160	--	--	200
Slovakia	--	465	--	--	465
South Africa	12	--	--	--	12
Spain	145	60	--	--	205
Turkey	15	404	--	--	419
Ukraine	--	120	20	80	220
United States	140	--	201	195	536
Total	1,300	8,810	346	1,020	11,500

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes capacity at operating plants, as well as at plants on standby basis.

TABLE 9
MAGNESITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country	2003	2004	2005	2006	2007[p]
Australia	472,668	473,963	474,000	446,000 r	450,000
Austria, crude	767,000	715,000	694,000	700,000	700,000
Brazil, beneficiated	306,444	366,174	386,759	323,902 r	324,000 p
Canada[e, 3]	180,000	180,000	180,000	180,000	180,000
China[e]	4,900,000 r	6,500,000 r	6,600,000 r	6,700,000 r	6,800,000
Colombia[e]	10,500	10,500	10,500	10,500	10,500
Greece, crude	549,049 r	499,474 r	475,670 r	500,000	500,000
India[e]	380,000	370,000	380,000	370,000	360,000
Iran	87,795	88,194	114,708 r	110,000 r, e	110,000
Korea, North[e]	1,000,000	1,200,000	1,200,000	1,200,000	1,200,000
Pakistan	2,645	6,074	3,029	4,000 e	4,200
Poland, concentrate	27,200 r	57,900 r	50,000 r	50,000 r, e	50,000
Russia[e]	1,200,000	1,200,000	1,100,000	1,200,000	1,200,000
Serbia, crude[e]	24,000 r, 4	20,000 r, 4	20,000 r, 4	20,000 r	20,000
Slovakia, concentrate	397,259 r	404,776 r	447,700 r	555,710 r	600,000
South Africa	86,100	65,900	54,800	73,300 r	73,000
Spain	517,030	567,504	485,800	500,000 e	500,000
Turkey, run-of-mine	3,224,278	3,732,952	2,372,206 r	2,088,033 r	2,100,000
United States	W	W	W	W	W
Zimbabwe	1,333	749	893	900 e	500
Total	14,100,000 r	16,500,000 r	15,100,000 r	15,000,000 r	15,200,000

eEstimated. pPreliminary. rRevised. W Withheld to avoid disclosing company proprietary data; not included in "Total."

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Figures represent crude salable magnesite. In addition to the countries listed, Bulgaria produced magnesite, but output is not reported quantitatively, and available information is inadequate for formulation of reliable estimates of output levels. Table includes data available through May 15, 2008.

[3]Magnesitic dolomite and brucite.

[4]Montenegro and Serbia formally declared independence in June 2006 from each other and dissolved their union.

MAGNESIUM COMPOUNDS

By Deborah A. Kramer

Domestic survey data and tables were prepared by Jesse J. Inestroza, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Although U.S. production of magnesium compounds in 2000 decreased from that in 1999, apparent consumption increased by about 7%. Production of dead-burned magnesia decreased by about 9%, mainly as a result of the closure of a plant in California, but net imports increased by 36%. Caustic-calcined magnesia production declined by about 4%, and net imports remained about the same. Of the total U.S. magnesium compounds production, about 60% came from seawater and well and lake brines. The remainder was recovered from magnesite, dolomite, olivine, and brucite. About 69% of the total consumption of magnesium compounds was for refractory applications. The remaining 31% was used in agricultural, chemical, environmental, and other applications.

Production

In 2000, domestic production of caustic-calcined magnesia declined slightly from that in 1999. U.S. production of dead-burned magnesia dropped by about 9% from that in 1999, mostly because of the closure of National Refractories and Minerals Corp.'s Moss Landing, CA, plant (table 3).

Data for magnesium compounds were collected by the U.S. Geological Survey from one voluntary survey of U.S. operations. Of the 17 operations canvassed, 71% responded, representing 65% of the magnesium compounds shipped and used (table 3). Data for the five nonrespondents were estimated on the basis of prior-year consumption levels and other factors.

Two companies in the United States produced olivine—Unimin Corp. and Olivine Corp. Unimin operated two mines, one in North Carolina and one in Washington, and processing plants in Indiana, North Carolina, and Washington. Olivine operated one mine and one processing plant in Washington.

Fused magnesia was produced by two companies in the United States—Newminco Inc. with a plant in Midway, TN, and Universal Ceramic Materials plc of the United Kingdom, which operated a plant in Cherokee, AL, through its Muscle Shoals Minerals Inc. subsidiary. The Tennessee plant had been owned by English China Clays International Ltd., which was required to sell the plant when it was acquired by Imerys (formerly Imetal). The plant was sold in June 2000 (Imerys, 2001, Annual report 2000, accessed May 17, 2001, via URL http://www.imerys.com).

The largest magnesite production facilities in the world are in China, North Korea, and Russia. Together, these three countries account for 68% of the world magnesite production capacity. Japan and the United States account for 54% of the world's magnesium compounds production capacity from seawater or brines. Fused magnesia is produced in Australia, Brazil, Canada, China, Israel, Japan, the Republic of Korea,

Magnesium Compounds in the 20th Century

Deposits of magnesite (magnesium carbonate) had been discovered in California in 1886, and by 1910, output of the ore from mines in Santa Clara County had reached 12,000 metric tons per year. Most of the ore was calcined and used by the manufacturers of paper in California and Oregon to treat wood pulp. In 1913, production of magnesia by precipitation of dolomite began in Pennsylvania, and in 1917, mining of magnesite began in Stevens County, WA. Imports of magnesite from Europe, which had been the dominant supplier to the United States, were cut off during World War I. Mining of the magnesite in the Nye County, NV, deposit began in 1937. At the outbreak of World War II, production of magnesian ores in the United States was accelerated to provide material not only for basic refractories but for magnesium metal as well. During World War II, almost 1 million metric tons of magnesite was mined and used to produce magnesium metal. Development of techniques to produce magnesium compounds other than magnesia, however, progressed slowly in the United States. By the end of 1959, more than 13 million tons of magnesite had been taken from the mines in the United States, but the deposits of easily recoverable magnesite in California had been worked out by 1950. In 1956, a broad expansion program began in the basic refractories industry in the United States. This included building new magnesia and basic-brick plants and installing new rotary kilns to burn dolomite, as well as improving and expanding production facilities already in operation. The greatest increase in production capacity was in plants to recover magnesia from seawater and brines. This production, which amounted to less than 40% of total domestic output in 1947, rose gradually to 66% in 1959. Domestic capacity for producing other magnesium compounds continued to increase steadily after World War II. Production of magnesium compounds in the United States peaked in 1966 and trended downward since then as imports replaced domestic production.

By 2000, only one magnesite mine was in operation in the United States in Nye County, NV. Magnesia and other magnesium compounds were produced from seawater at plants in Delaware and Florida, from well brines in Michigan, and from brines from the Great Salt Lake in Utah. Imports of magnesia, mainly from China, supplied about 48% of the total U.S. apparent consumption of magnesium compounds. About 69% of the magnesium compounds consumed in the United States was used for refractories. The remaining 31% was consumed in agricultural, chemical, construction, environmental, and industrial applications. U.S. imports for consumption continued to increase significantly in 2000.

Mexico, Russia, the United Kingdom, and the United States. World production capacity is estimated to be about 650,000 metric tons per year (t/yr), with about 500,000 t/yr of capacity in China (Pearson, 2000).

Norway is the world's principal producer and supplier of olivine. Other producers include Australia, Italy, Japan, Mexico, Pakistan, Spain, and the United States.

In August 2000, Premier Services Inc. increased the caustic-calcined magnesia capacity at its Gabbs, NV, magnesite facility by 20,000 t/yr to 140,000 t/yr. The capacity increase was in response to growing demand in the wastewater treatment market. About $1 million was spent on an incremental furnace expansion, and Premier Services said that the company may expand further in 2001 if the growth in the market continues (North American Minerals News, 2000c).

Aurora Partners Ltd. of the United States announced that it would form a joint venture with North Korea's Korea Magnesite Clinker Industry Group to mine, process, and ultimately export magnesia products from North Korea. This would be the first joint venture between U.S. and North Korean firms. Although North Korea has been allowed to export magnesite to the United States since 1995, no material has entered since then. An embargo preventing U.S. firms from establishing joint ventures with North Korean companies was lifted in June 2000 (North American Minerals News, 2000a).

Near the end of the year, the State of Utah began modifying the salinity levels in the Great Salt Lake by deepening a causeway opening by more than 2.4 meters (8 feet). The railroad causeway in the lake has been acting as a dam and creating essentially two separate bodies of water with different salinity levels. Deepening the breach in the causeway would allow for greater water flow between the two bodies, thereby equalizing the salinity levels. Although it could be 3 to 5 years before the effects of the causeway modifications are known, this could adversely affect companies that recover magnesium chloride from the higher salinity portion of the Great Salt Lake (Green Markets, 2001).

As part of RHI AG's 1999 acquisition of Global Industrial Technologies Inc., which was the parent company of Harbison-Walker Refractories Inc., RHI was required by the U.S. Federal Trade Commission (FTC) to divest itself of some of its assets. According to a consent agreement, RHI would be required to divest two refractory manufacturing plants in North America as well as assets related to certain refractory products produced at a third North American location. The divestiture was agreed to because, after the merger of RHI and Global, the two companies combined would control about 95% of the $30 million North American market for magnesia-carbon bricks for basic-oxygen furnaces (BOFs) used in the steelmaking industry. In addition, the merged company would hold 65% of the $58 million market for magnesia-carbon bricks for electric-arc furnaces, 40% of the $100 million market for magnesia-carbon bricks for steel ladles used with BOFs, 70% of the $50 million market for high-alumina bricks for steel ladles used with BOFs, 50% of the $23.5 million market for high-alumina bricks for torpedo cars, and 46% of the $5 million market for magnesia-chrome bricks for steel degassers. As a result of its market dominance in these sectors, the FTC ordered RHI to sell to Resco Products Inc. two magnesia-chrome-brick-producing plants (one in Hammond, IN, and one in Marelan, Quebec, Canada) and specific assets related to the production of high-alumina bricks at its Farber, MO, plant. Resco manufactures similar refractory products, but does not compete in the same markets (U.S. Federal Trade Commission, December 30, 1999, FTC clears proposed acquisition of Global Industrial Technologies by RHI AG, accessed March 14, 2001, at URL http://www.ftc.gov/opa/1999/9912/rhi1.htm).

Consumption

In 2000, environmental applications (water treatment and stack gas scrubbing, in descending order) consumed the most caustic-calcined magnesia, accounting for 41% of U.S. shipments; this was a 4% increase from the 1999 total. The following categories, with the individual components in descending order of consumption in parentheses, were the other end-use sectors for caustic-calcined magnesia: chemical, 34%; agriculture (animal feed and fertilizers), 18%; construction (primarily oxychloride and oxysulfate cements), 3%; manufacturing (rubber, fuel additives, and electrical), 3%; pharmaceuticals and nutrition (sugar, medicine and pharmaceuticals, and cosmetics), less than 1%; and unspecified uses, less than 1%.

Magnesium carbonate was used principally as a chemical intermediate, in medicines and pharmaceuticals, in rubber processing, and in cosmetics (uses are given in descending order of quantity). Magnesium hydroxide was used mainly in the chemical industries and for water treatment. Magnesium sulfate was used mostly for animal feed, pulp and paper, chemical, electrical, and pharmaceutical applications. Magnesium chloride was used mainly as a chemical intermediate and in pharmaceuticals. Magnesium chloride brines were used principally for road dust and ice control and as a chemical intermediate.

Foundry uses remained the largest application for olivine in the United States, accounting for 87% of consumption of domestically produced material. Refractory applications accounted for 7% of U.S. consumption, and sandblasting and other abrasive uses accounted for 6%.

Prices

Yearend 2000 prices for magnesium compounds quoted in Chemical Market Reporter and Industrial Minerals remained the same as those for 1999 (table 4).

Foreign Trade

In 2000, dead-burned magnesia exports from the United States declined by about 10% (table 5). Canada, with 85% of the total, was the principal destination. Caustic-calcined magnesia exports, however, increased to nearly four times the 1999 level. Mexico (26%), Japan (19%), Brazil (11%), and the Netherlands (11%) were the main destinations.

U.S. imports of dead-burned magnesia in 2000 increased by 28% from those in 1999 (table 7). China (69%) and Australia (13%) were the principal source countries. One of the reasons for the significant increase in imports was to replace some of the domestically produced material that was lost when National Refractories and Minerals closed its magnesia plant in 1999.

Imports of caustic-calcined magnesia increased by 11% from imports in 1999. China (65%) and Canada (29%) were the primary sources. In spite of the export licensing requirements imposed by the Chinese Government, magnesia exports from

China to the United States continued to rise. For 2000, the Chinese export quota for magnesite was 1.6 million metric tons (Mt), and the license fee was about $43 per metric ton. Because of falling magnesite prices, many Chinese producers joined to form two separate export syndicates. The producers expected to be able to control prices and export volumes more easily through these syndicates (Industrial Minerals, 2000f).

Trade data for olivine are not available separately from the U.S. Census Bureau. The Journal of Commerce Port Import/Export Reporting Service (PIERS), however, provides data on material that travels by ship. PIERS data indicate that in 2000 the United States exported 871 metric tons (t) of olivine; Argentina (42%), Venezuela (12%), and Brazil (11%) were the principal destinations. U.S. olivine imports totaled 202,000 t, a 73% increase from imports in 1999. Norway (70%) and Poland (28%) were the major source countries.

World Review

Australia.—SAMAG Ltd., the 80%-owned subsidiary of Pima Mining NL, began trial mining of its magnesite deposit in South Australia. The company plans to mine about 2,000 t of ore for trial leaching tests. The company also selected Port Piric as the site for its proposed 52,500-t/yr magnesium plant. This site was chosen because of its existing infrastructure (the Pasminco zinc smelter is located at the same site), the rail link between Port Pirie, and the location of the magnesite raw material near Leigh Creek. Initial investment in the plant was expected to begin in 2001, with commercial production scheduled for 2004. The company has licensed The Dow Chemical Co.'s electrolytic technology for magnesium production (Metal Bulletin, 2000). SAMAG also purchased the Myrtle Springs and the Huandot magnesite deposits from Unimin Australia Ltd., which increased the company's total magnesite resources in the Leigh Creek, Northern Territory, area to 579 Mt (Pima Mining NL, November 28, 2000, SAMAG purchases additional magnesite resources, accessed January 8, 2001, at URL http://www.pima.com.au/temp.asp?t=asx28nov00).

In October, Mt. Grace Resources NL began bulk magnesite mining operations at its Batchelor magnesium project. The company planned to mine and stockpile 2,000 t of magnesite to provide sample material for test work. An ore parcel was expected to be sent to Mintek in Johannesburg, South Africa, in January for testing (Mt. Grace Resources NL, October 30, 2000, Mt[.] Grace Resources mines ore at Batchelor, accessed November 8, 2000, at URL http://www.mtgrace.com/releases/oct_30_2000.html). Mt. Grace Resources plans to construct a 50,000-t/yr magnesium plant by 2006.

At the end of June, Unimin acquired Normandy Mining Ltd.'s mining assets, which included all its activities under its Commercial Minerals Ltd. subsidiary. Commercial Minerals operates a magnesite mining operation near Myrtle Springs, South Australia (Industrial Minerals, 2000h).

Canada.—Globex Mining Enterprises Inc. acquired the Deloro magnesite deposit after its previous owner, Royal Oak Mines Inc., filed for bankruptcy. Drilling on the property has delineated a resource of more than 100 Mt of ore, containing more than 50% magnesite, 25% to 30% talc, and 16% quartz. The company was reviewing test results conducted in 1991 and was planning to conduct bulk sampling tests before determining how it would develop the deposit (North American Minerals News, 2000b).

China.—For 2001, the quantity of magnesia available for export was the same as it was in 2000—1.6 Mt. The export license fee, however, decreased by approximately $1 per metric ton to $42 per metric ton (Houssa, 2001).

Greece.—Grecian Magnesite S.A. embarked on an investment program designed to improve processing at its operations in Greece and to internationalize the company. As part of its internationalization strategy, Grecian Magnesite acquired 40% of the Spanish holding company Magna Inversiones S.A., which owns the Spanish magnesite producer Magnesitas Navarras S.A. Grecian Magnesite also plans to add two new mineral processing lines that are intended to increase productivity, reduce production costs, and improve the company's environmental protection efforts. The total cost of the acquisition and the production modifications was estimated to be $7 billion, and part of this investment was expected to be financed through stock offering on the Athens Stock Exchange Market (Grecian Magnesite S.A., June 20, 2000, Investment program of Grecian Magnesite S.A., accessed February 12, 2001, at URL http://www.grecianmagnesite.com/Press/pr20062000.html). As part of Grecian Magnesite's modifications, Bateman Project Holdings Ltd. supplied a new 30-metric-ton-per-hour dense-media separation plant to its mine at Yerakini, which was designed to separate waste rock from magnesite.

India.—Almora Magnesite Ltd. was referred to India's Board of Industrial Finance and Reconstruction for assessment of its finances. As a result, the company was looking for foreign investment to develop its magnesite mines and to upgrade its beneficiation plant. Almora Magnesite produced about 50,000 t/yr of crude magnesite and 20,000 t/yr of dead-burned magnesia at its plant in Uttar Pradesh. Competition from imports of Chinese magnesite and a downturn in the domestic steel industry had put financial pressure on India's magnesite producers. In addition, the dead-burned magnesite produced in India has a high silica content, which makes it unsuitable for production of many higher value refractories such as magnesia-carbon brick (Industrial Minerals, 2000a).

Israel.—Dead Sea Periclase Ltd. announced that it would increase magnesium hydroxide production capacity at its Mishor Rotem plant to 9,000 t/yr, a 3,000-t/yr increase. The first phase of the two-phase expansion was completed in September; the remaining capacity was expected to be completed by early 2001. The company was increasing its capacity because of a successful audit from the country's Food and Drug Administration. The successful audit was expected to increase demand for the company's magnesium hydroxide from the food and pharmaceutical industry (Chemical Week, 2000).

Jordan.— Jordan Magnesia Co. received a $30-million loan from a syndicate of banks, which would allow it to proceed with construction of its planned magnesia plant. The company already had received $28 million from the Islamic Development Bank and the Islamic Portfolio. The total cost of the plant was estimated to be $101 million. Plant commissioning was scheduled for the beginning of 2001, and the annual plant capacity will be 50,000 t of dead-burned magnesia and 10,000 t of specialty magnesium compounds. About 489,000 cubic meters per year of magnesium chloride-rich brine from Arab Potash Co.'s existing solar ponds and 165,000 t/yr of limestone mined from a quarry at nearby Qatrana will supply the plant's feedstock (Fertilizer International, 2000).

Russia.—After celebrating a century of mining in September and extracting its 200 millionth metric ton of ore from the Satka magnesite deposits in August, JSC Kombinat Magnezit announced plans to improve its magnesite mining and processing operations. Magnezit operated two open pit mines, one underground mine, and two beneficiation plants with a capacity to produce about 2.5 Mt of magnesia products annually. The company planned to construct a briquetting and processing plant that can use dust from its magnesite beneficiation operation as feed material. The company also acquired the mining rights to the Goluboe magnesite deposit, which has reserves of 6 Mt, including 2 Mt of magnesite containing 45% MgO. Magnezit planned to construct a fused magnesia plant using magnesite from the Goluboe deposit as feed material. Magnezit also planned to prolong the life of its open pit mines by mining more ore from its underground mine (Industrial Minerals, 2000d, e).

Magnitogorsk Iron and Steel Works, one of Russia's largest steel producers, commissioned a new magnesia-dolomite refractories plant in 2000. The first stage of the new operation, with a capacity of 12,000 t/yr, began producing magnesia-carbon bricks to replace refractories previously purchased from Magnezit. The second stage was expected to add 18,000 t/yr of dolomite refractories production to the plant. Total cost of the project was estimated to be $40 million. When the plant is completed, Magnitogorsk will be able to supply about 70% of its refractories needs with material produced in-house (Industrial Minerals, 2000g).

Turkey.—In May, Austria's Styromagnesit Steirische Magnesitindustrie GmbH (Styromag) purchased Comag Continental Mining Industry & Trade Co. Inc. The purchase included Comag's mine and plants in Middle Anatolia, Turkey, with a capacity of 50,000 t/yr of caustic-calcined magnesite, that had been shut since March. Styromag planned to restart the operation in July under the name Calmag. Previously, much of the operation's production had been used for animal feed, but Styromag wanted to concentrate on sales of fused magnesia. The acquisition would also broaden Styromag's product line of caustic-calcined magnesia products—Styromag produced crystalline magnesite at its Austrian operation, and the Calmag operation produced cryptocrystalline magnesite (Industrial Minerals, 2000i).

The Turkish refractories producer Haznedar Ates Tugla Sanayii A.S. planned to begin production in early 2001 at a new refractories operation in Istanbul. The new plant will replace an old 30,000-t/yr operation producing magnesia-carbon and alumina bricks. The new plant, which will produce about 50,000 to 60,000 t/yr of high-density alumina and magnesia bricks, will incorporate some of the old equipment into the new facility. The company hoped to improve product quality. About 75% of the refractories were used locally, and the rest were exported to neighboring countries (Industrial Minerals, 2000c).

Current Research and Technology

Krosaki Harima Corp. developed a new brand of refractory product that was considered to be more environmentally friendly than traditional refractories. In the alumina monolithics that the company produced, it replaced the Cr_2O_3 with MgO. Replacing the Cr_2O_3 with MgO eliminates the generation of hexavalent chromium, which can lead to environmental problems when discarding the refractories (Industrial Minerals, 2000b).

Outlook

Because the primary use of refractory magnesia is in iron and steel production furnaces, economic factors that influence the production of iron and steel will have a direct effect on the consumption of refractory magnesia. According to the International Iron and Steel Institute, the North American steel industry is concerned about higher energy prices and increased levels of imports (International Iron and Steel Institute, October 3, 2000, IISI survey reveals renewed world steel consumption growth, accessed April 16, 2001, at URL http://www.worldsteel.org/trends_indicators/demand.html). If energy costs remain high or increase, it could lead to closure of some North American steel production capacity. This, in turn, could lead to higher levels of imports, which would be required to supply the steel demand. Also, if the U.S. economy becomes stagnant or enters a recession, the total demand for steel is likely to decline as well. A decline in steel demand coupled with closure of U.S. capacity would lead to a significantly reduced demand for refractory magnesia.

Imports of magnesite, mainly from China, are expected to continue to supply much of the U.S. demand for magnesia for refractory applications. If material from North Korea becomes available on the U.S. market, it would probably provide an additional source of low-cost magnesia to U.S. refractories manufacturers at the expense of domestically produced material. Consumption of caustic-calcined magnesia, however, is expected to continue to be strong. Because it has such diverse applications, a decline in one particular industry sector is not as devastating as a drop in steel production is to the refractory magnesia industry. Such environmental applications as wastewater treatment are expected to continue to be the principal growth area for caustic-calcined magnesia.

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TABLE 1
SALIENT MAGNESIUM COMPOUND STATISTICS 1/

(Thousand metric tons, unless otherwise specified)

		1996	1997	1998	1999	2000
United States:						
Caustic-calcined and specified magnesias: 2/						
Shipped by producers: 3/						
Quantity		158	160	177	179	172
Value	thousands	$47,600	$52,600	$76,700	$77,000	$46,000
Exports 4/		20	5	5	3	12
Imports for consumption 4/		114	133	127	123	136
Refractory magnesia:						
Shipped by producers: 3/						
Quantity		269	283	215	216	196
Value	thousands	$96,800	$97,500	$75,000	$75,300	$68,100
Exports		73	66	63	67	60
Imports for consumption		271	279	427	392	501
World production (magnesite)		11,000	10,400	11,800 r/	10,500 r/	10,700 e/

e/ Estimated. r/ Revised.

1/ Data are rounded to no more than three significant digits.

2/ Excludes caustic-calcined magnesia used in the production of refractory magnesia.

3/ Includes magnesia used by producers.

4/ Caustic-calcined magnesia only.

TABLE 2
U.S. MAGNESIUM COMPOUND PRODUCERS, BY RAW MATERIAL SOURCE, LOCATION, AND PRODUCTION CAPACITY, IN 2000

Raw material source and producing company	Location	Capacity (metric tons of MgO equivalent) 1/	Products
Brucite: Applied Chemical Magnesias Corp.	Van Horn, TX; and Bullhead City, AZ	25,000	Magnesium hydroxide.
Magnesite: Premier Services Inc	Gabbs, NV	140,000	Caustic-calcined and dead-burned magnesia.
Lake brines:			
IMC Kalium Ogden Corp.	Ogden, UT	105,700	Magnesium chloride and magnesium chloride brines.
Reilly Industries Inc.	Wendover, UT	45,000	Magnesium chloride brines.
Well brines:			
The Dow Chemical Co. 2/	Ludington, MI	214,000	Magnesium hydroxide.
Martin Marietta Magnesia Specialties Inc. 3/	Manistee, MI	297,000	Caustic-calcined and dead-burned magnesia.
Rohm and Haas Co.	do.	10,000	Magnesium carbonate, magnesium hydroxide, and caustic-calcined magnesia.
Seawater:			
Barcroft Co.	Lewes, DE	5,000	Magnesium hydroxide.
Premier Services Inc.	Port St. Joe, FL	50,000	Caustic-calcined magnesia and magnesium hydroxide.
Western Salt Co.	Chula Vista, CA	3,000	Magnesium chloride brines.
Total		894,700	

1/ Data are rounded to no more than three significant digits; may not add to total shown.

2/ Most of Dow's production was shipped to RHI Refractories America Inc. in Ludington, MI, where it was converted to dead-burned magnesia at a 200,000-metric-ton-per-year plant.

3/ In addition to its Michigan plant, Martin Marietta owned a 30,000-metric-ton-per-year magnesium hydroxide plant in Pittsburgh, PA, and a 15,000-metric-ton-per-year magnesium hydroxide plant in Lenoir City, TN, which used imported magnesite as a raw material.

TABLE 3
U.S. MAGNESIUM COMPOUNDS SHIPPED AND USED 1/

	1999		2000	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesias 2/	179,000	$77,000	172,000	$46,000
Magnesium hydroxide [100% Mg(OH)2] 2/	233,000	44,100	212,000	81,700
Magnesium sulfate (anhydrous and hydrous)	47,100	14,500	44,000	12,700
Precipitated magnesium carbonate 2/	2,190	4,890	1,960	4,650
Refractory magnesia	216,000	75,300	196,000	68,100

1/ Data are rounded to no more than three significant digits.

2/ Excludes material produced as an intermediate step in the manufacture of other magnesium compounds.

TABLE 4
YEAREND MAGNESIUM COMPOUND PRICES

Material		1999	2000
Magnesia, natural, technical, heavy, 85%, f.o.b. Nevada	per short ton	$232-$265	$232-$265
Magnesia, natural, technical, heavy, 90%, f.o.b. Nevada	do.	265	265
Magnesia, dead-burned	do	350	350
Magnesia, synthetic, technical	do.	385	385
Magnesium chloride, hydrous, 99%, flake	do.	290	290
Magnesium carbonate, light, technical, freight equalized	per pound	0.73-0.78	0.73-0.78
Magnesium hydroxide	do.	0.45	0.45
Magnesium sulfate, technical, epsom salts	do.	0.18-0.195	0.18-0.195
Olivine, aggregate, f.o.b. plant or mine	per metric ton	50-78	50-78
Olivine, foundry grade, f.o.b. plant or mine	do.	60-110	60-110

Sources: Chemical Market Reporter and Industrial Minerals.

TABLE 5
U.S. EXPORTS OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY 1/

	1999		2000	
Material and country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined magnesia:				
Brazil	122	$126	2,170	$2,980
France	95	42	1,080	525
Germany	689	339	748	405
Japan	--	--	1,310	1,750
Mexico	1,220	613	3,020	983
Netherlands	573	294	1,280	717
Other	492 r/	265 r/	2,000	1,110
Total	3,190	1,680	11,600	8,470
Dead-burned and fused magnesia:				
Canada	51,800	15,700	50,300	14,800
Hong Kong	176	213	1,650	1,920
Korea, Republic of	998	543	2,140	1,570
Mexico	690	339	429	231
Netherlands	6,460	2,100	622	265
Philippines	2,000	600	--	--
United Kingdom	1,380	3,140	181	351
Other	3,270 r/	2,620 r/	4,500	3,310
Total	66,700	25,200	59,800	22,400
Other magnesia:				
Canada	5,180	2,040	5,090	1,950
Hong Kong	1,580	1,900	775	1,020
Mexico	4,790	4,590	5,610	4,680
New Zealand	146	217	2,120	1,980
Spain	961	1,080	671	812
Taiwan	454	254	245	218
Venezuela	2	$25	2,670	$712
Other	2,660 r/	3,230 r/	4,230	7,590
Total	15,800	13,300	21,400	19,000
Crude magnesite:				
Brazil	1,140	129	2,870	306
Canada	3,490	540	3,520	504
Germany	6,520	796	5,740	621
Korea, Republic of	4,500	512	1,250	136
Mexico	6,140	699	2,750	311
Netherlands	740	79	3,130	424
Spain	168	25	2,960	316
Venezuela	2,950	323	2,100	239
Other	3,220 r/	419 r/	5,180	601
Total	28,900	3,520	29,500	3,460

r/ Revised. -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 6
U.S. EXPORTS OF MAGNESIUM COMPOUNDS 1

Material	1999 Quantity (metric tons)	1999 Value (thousands)	2000 Quantity (metric tons)	2000 Value (thousands)	Principal destinations, 2000
Magnesium chloride, anhydrous and other	4,420	$2,310	4,900	$15,800	Canada, 79%; India, 14%.
Magnesium hydroxide and peroxide	18,900	7,540	20,200	10,600	Canada, 70%.
Magnesium sulfate, natural kieserite and epsom salts	393	210	453	224	Honduras, 44%; Ireland, 27%.
Magnesium sulfate, other	5,140	2,260	6,200	2,970	Canada, 87%.

1/ Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 7
U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY 1/

Material and country	1999 Quantity (metric tons)	1999 Value (thousands)	2000 Quantity (metric tons)	2000 Value (thousands)
Caustic-calcined magnesia:				
Canada	43,100	$7,630	38,700	$6,760
China	71,500	7,650	88,500	9,940
Greece	5,080	1,220	5,000	1,200
Other	2,950	2,590	4,070	4,170
Total	123,000	19,100	136,000	22,100
Dead-burned and fused magnesia:				
Australia	45,400	11,900	65,900	14,800
Austria	19,800	11,400	21,500	9,860
Brazil	15,500	2,790	10,000	990
China	275,000	34,900	345,000	44,600
Greece	7,740	1,340	3,030	558
Hong Kong	4,000	368	18,300	2,280
Israel	3,400	4,000	9,820	7,220
Other	21,400	8,360	27,100	7,860
Total	392,000	75,000	501,000	88,200
Other magnesia:				
Canada	4,550	$925	6,250	$1,180
China	1,670	832	275	209
Israel	4,330	7,190	2,870	5,130
Japan	1,670	2,880	1,680	3,150
Mexico	3,440	1,930	4,700	2,270
Other	2,230	1,100	3,130	2,200
Total	17,900	14,900	18,900	14,100
Crude magnesite:				
China	4,080	708	6,010	776
Israel	639	203	979	202
Japan	962	212	2,530	558
United Kingdom	1,210	291	3,520	953
Other	1,010 r/	305 r/	1,540	337
Total	7,900	1,720	14,600	2,830

r/ Revised.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM COMPOUNDS 1/

	1999		2000		
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Principal sources, 2000
Magnesium chloride, anhydrous and other	24,500	$5,600	35,800	$7,210	Israel, 91%
Magnesium hydroxide and peroxide	7,440	12,600	8,960	14,700	Japan, 35%; Israel, 28%; Netherlands, 12%
Magnesium sulfate, natural epsom salts	82	64	85	23	Germany, 90%
Magnesium sulfate, natural kieserite	23,800	595	27,000	831	Germany, 100%
Magnesium sulfate, other	26,700	5,170	31,800	7,030	Germany, 56%; Canada, 33%

1/ Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 9
WORLD MAGNESIUM COMPOUNDS ANNUAL PRODUCTION CAPACITY, DECEMBER 31, 2000 1/ 2/

(Thousand metric tons, MgO equivalent)

	Raw material				
	Magnesite		Seawater or brines		
Country	Caustic-calcined	Dead-burned	Caustic-calcined	Dead-burned	Total
North America:					
Canada	100	--	--	--	100
Mexico	--	--	20	95	115
United States	NA	NA	NA	NA	895 3/
Total	100	NA	20	95	1,110
South America, Brazil	58	276	--	--	334
Europe:					
Austria	35	250	--	--	285
France	--	--	30	--	30
Greece	120	80	--	--	200
Ireland	--	--	--	90	90
Italy	25	--	5	130	160
Netherlands	--	--	--	150	150
Norway	--	--	25	--	25
Poland	--	10	--	--	10
Russia	100	2,670	--	--	2,770
Serbia and Montenegro	40	200	--	--	240
Slovakia	--	440	--	--	440
Spain	155	60	--	--	215
Turkey	50	324	--	--	374
Ukraine	--	120	20	80	220
United Kingdom	--	--	70	80	150
Total	525	4,160	150	530	5,360
Africa:					
Kenya	NA	NA	--	--	170
South Africa	7	--	--	--	7
Total	7	NA	--	--	177
Asia:					
China	200	2,480	--	10	2,690
India	25	257	--	--	282
Iran	--	30	--	--	30
Israel	--	--	10	60	70
Japan	--	--	65	265	330
Korea, North	--	500	--	--	500
Korea, Republic of	--	--	--	50	50
Total	225	3,260	75	385	3,950
Oceania, Australia	48	120	--	--	168
Grand total	963	7,810	245	1,010	11,100

NA Not available. -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Includes capacity at operating plants, as well as at plants on standby basis.
3/ Includes capacity for production of magnesium chloride, magnesium chloride brines, magnesium carbonate, magnesium hydroxide, and caustic-calcined and dead-burned magnesias.

TABLE 10
MAGNESITE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1996	1997	1998	1999	2000 e/
Australia	237,707	245,192	360,115 r/	280,505 r/	349,783 3/
Austria	624,000	650,000 e/	723,000 r/	769,000 r/	750,000
Brazil (beneficiated) 4/	306,737	294,629	308,300	310,000 e/	310,000
Canada e/ 5/	180,000	180,000	180,000	180,000	180,000
China e/	2,100,000	2,400,000	2,400,000	2,450,000	2,500,000
Colombia e/	12,634 r/ 3/	10,500	10,500	10,500	10,500
Greece	682,346	623,050	650,000 e/	650,000 e/	650,000
India	373,306	362,929	355,033	360,000 e/	365,000
Iran 6/	55,000 r/ e/	55,000 r/ e/	109,597 r/	141,081 r/	141,000
Korea, North e/	1,600,000	1,600,000	1,600,000	1,000,000	1,000,000
Mexico	200	231	274	308 r/	335 3/
Pakistan	3,202	4,057	3,157	3,000 e/	3,100
Philippines e/	700	700	700	700	700
Poland	19,300	6,403	5,745	6,000 e/	--
Russia e/	1,000,000	1,040,000	851,845 3/	900,000	1,000,000
Serbia and Montenegro	89,000	95,000	81,000 r/	22,000 r/	40,000
Slovakia	824,800	863,600	877,840	850,000 e/	850,000
South Africa	71,358	76,669	74,300	74,000 r/	74,000
Spain e/	483,726 3/	500,000	500,000	500,000	500,000
Turkey (run of mine)	2,339,138	1,409,768	2,703,343	2,000,000 r/ e/	2,000,000
United States	W	W	W	W	W
Zimbabwe	10,659	13,050	4,321	4,000 e/	4,000
Total	11,000,000	10,400,000	11,800,000 r/	10,500,000 r/	10,700,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

1/ World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

2/ Figures represent crude salable magnesite. In addition to the countries listed, Bulgaria produced magnesite, but output is not reported quantitatively, and available information is inadequate for formulation of reliable estimates of output levels. Table includes data available through May 18, 2001.

3/ Reported figure.

4/ Series reflect output of marketable concentrates. Production of crude ore was as follows, in tons: 1996--1,268,265; 1997--1,030,171; and 1998-2000--1,050,000 (estimated)

5/ Magnesitic dolomite and brucite. Figures are estimated on the basis of reported tonnage dollar value.

6/ Year beginning March 21 of that stated.

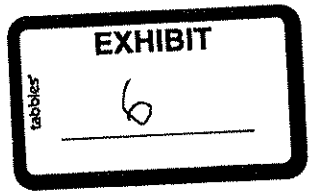
HighBeam Research

Title: China Jiayuan Magnesite Export Group.

Date: 8/1/2000; **Publication**: E-MJ - Engineering & Mining Journal;

China Jiayuan Magnesite Export Group has been formed by 13 Chinese magnesite enterprises comprising Liaoning Haicheng Houying Magnesite, Xiyang Refractory Material, Yingkou Huachen, Liaoning Foreign Trade, and Dalian Metals and Minerals Import and Export companies.

Currently, this group produces more than 70% of total magnesite output and 50% of the export quota in China. As China's magnesite exports exceed an 80% world-market share, the group is expected to have an important influence on international magnesite prices. Competition at a low price due to magnesite overproduction had led to a decline in its prices to the lowest on the world market ($85/mt) by yearend 1999. Based on the figure, China lost about RMB [yen]140/mt dead-burnt-magnesite exported.



April 11, 2000

RDS-ACC-NO: 02399765

LENGTH: 187 words

HEADLINE: MAGNESITE EXPORT GROUP SET UP IN CHINA'S DALIAN

HIGHLIGHT:
A group of 13 companies form a magnesite export group in Dalian, China, in a move that may bring an additional USDlr50 mil/yr worth of income to the region China accounts for around 80% of global magnesite reserves

BODY:

DALIAN, April 11 Asia Pulse - A magnesite export group has been set up in Dalian, a coastal city in Northeast China's Liaoning Province.

The group has 13 member companies. They have reached agreement on unifying prices to avoid underselling. The move may bring in an additional $US50 million of income each year.

China has rich magnesite resources, about 80% of the world's total. The magnesite mines are mainly scattered in Haicheng, Dashiqiao and Youyan in Northeast China's Liaoning Province.

Magnesite is an indispensable raw material in the making of refractory materials. It is widely used in steel and non-ferrous metal making, cement production and glass works.

The 13 member companies of the group mainly include the Haicheng Xiyang Refractory Materials Corporation, the General Group of Haicheng Houying Magnesite Products, the Yingkou Huachen Co., Ltd., the Liaoning Foreign Trade Corporation, the Dalian Golden Sun Import and Export Co., Ltd., and the Haicheng Zhisheng Magnesite Products Co.

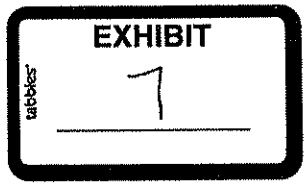
They operated more than 50% of the quota licenses for the country's magnesite exports in 1999.

(XIC)

TYPE: Custom Wire; Fulltext

JOURNAL-CODE: ASIAPULS

LOAD-DATE: April 21, 2000



August 18, 2000

LENGTH: 106 words

HEADLINE: INDUSTRIAL MINERALS: Magnesium carbonate producers form export syndicates

BODY:

Chinese leading magnesite producers formed an alliance, Jia Yuan Magnesite Export Group, on 9 Apr 2000.

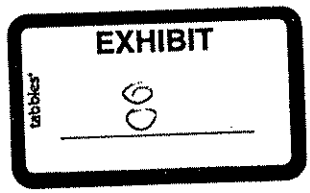
The move was aimed to stabilise magnesite prices which have severely dipped due to high costs of labour and energy.

Chinese magnesite prices have an average of $90-$100/tonne FOB which gives the producers a difficult time to derive profits.

The alliance members have signed a deal to ship their products at the same price.

There are about 13 companies involved, including Xiyang Refractory Co, Houying Magnesite Mine, Yingkou Huacheng Group, Liaoning Foreign Trade Corp and Dalian Jinyang Import & Export Co.Newswire

LOAD-DATE: August 21, 2000



LexisNexis®

CHEMICAL BUSINESS NEWSBASE

August 22, 2000

LENGTH: 75 words

HEADLINE: INDUSTRIAL MINERALS: Second Chinese magnesium carbonate export group formed

BODY:

A second magnesium carbonate group has been formed in China.

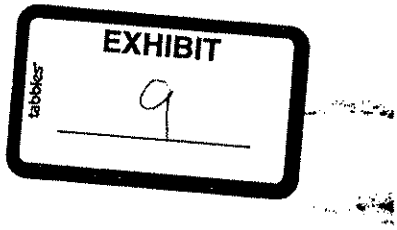
Huaxia Magnesium Products Export Group is made up of 25 companies.

These include Liaoning Jiayi Industrial Development, Haicheng Huayu Group, Shenyang Metals & Minerals and CITIC Trading.

The group indicates that it will account for over 55% of Chinese magnesium products.

However, the first export group Jia Yuan, has also claimed to have 50-60% of total export licence for magnesite.Newswire

LOAD-DATE: August 22, 2000



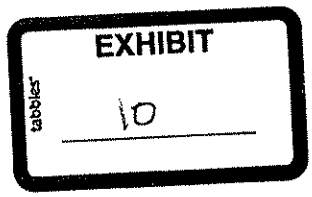
2001 June

The Nation's Magnesite Self-Regulation Initiatives is showing Results

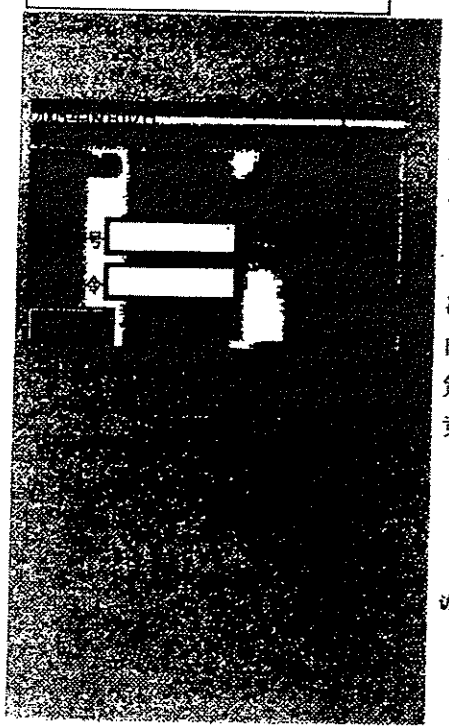
According to statistics, the nation's Magnesite Self-Regulation Initiatives is showing positive results. From April 9th onwards, after 13 manufacturers formed the Jiayuan Magnesite Export Group in Dalian, the market price for magnesite rebound quickly. Currently, the price of fused magnesia has risen from the lowest of USD 85 to USD 116.

Magnesite is a non-renewable mineral. The southern part of Liaoning Province is the source for the best quality of magnesite in the world. However in the recent years, due to price competition among some companies that resulted in price-cutting and dumping, the export price of magnesite has suffered a great downfall. In order to turn the situation around, the 13 major enterprises in the magnesite industry formed the Jiayuan Magnesite Export Group. The group aimed to unify export management, price reporting, export contracts and administrative procedures in order to compete orderly in the international market. Foreign companies are now actively placing order and giving deposits, hence greatly reduce the investment risk of the magnesite industry. The recovery of the international magesite market also brings along activities in the nation's magnesite industry. Factories that have previously shut down production are now reopened and workers are re hired back to the production line.

The President of the Board of Directors of Jiayuan Magnesite Export Group Mr Shun Shoukuan stated that the success of the group initiative was achieved through the ardent support from relevant official government units, and the stability of existing policy. If applied effectively, the initiative would give the nation 50 million USD of export sales, without any additional effort or involvement from the government. It provided excellent protection to the nation's limited resources. However, the participating companies in this initiative are taking a huge risk and a difficult task. He hopes that the nation's related policy will continue to maintain stability and continuity in the long run, in order to bring into greater effect the results of this initiative, and make the nation's magnesite industry competitive in the international market. The rebound of the magnesite price would also benefit the local economy of the area.



中国五矿化工进出口商会

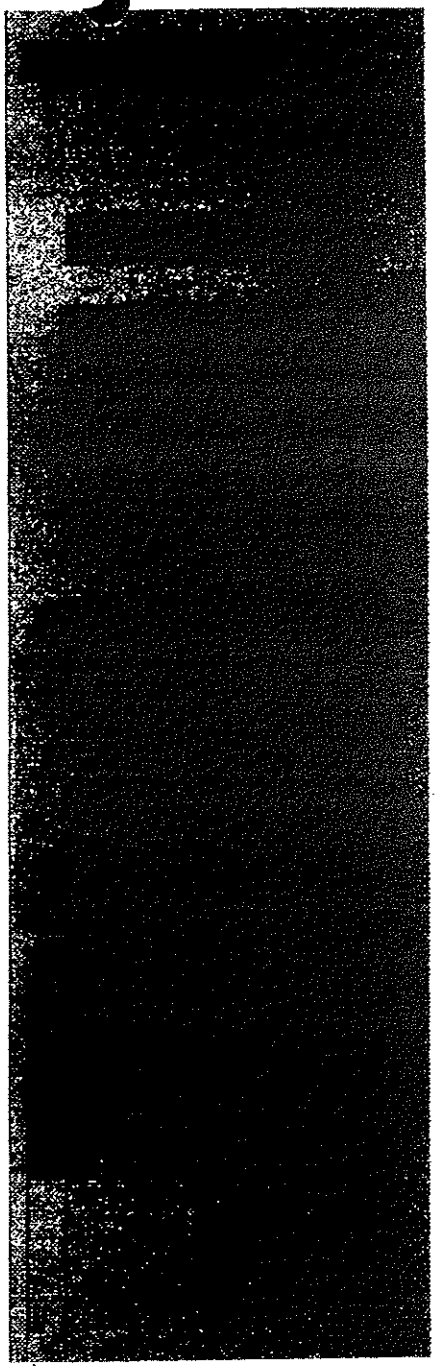


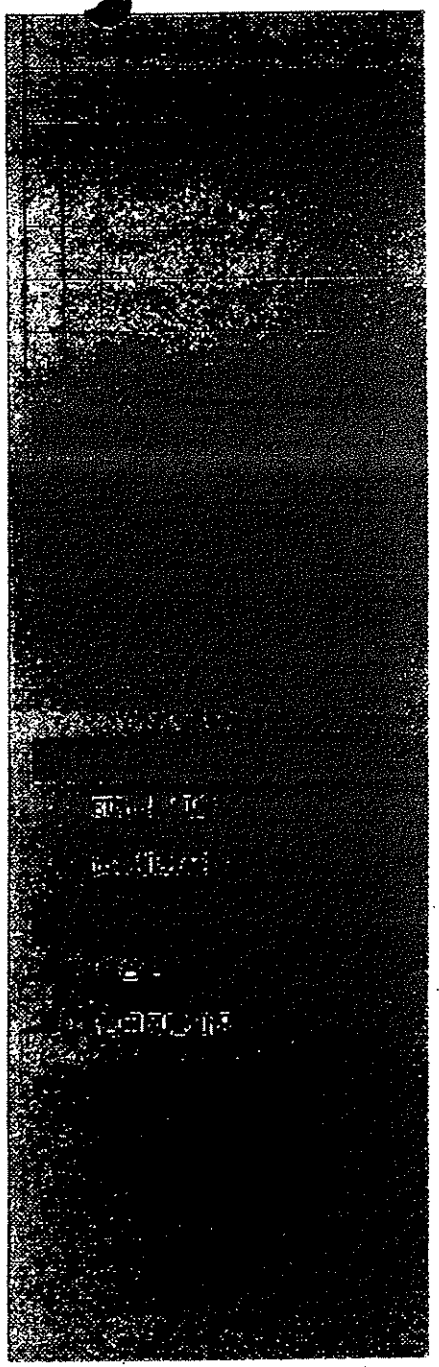
出口镁砂价格回升(2001年6月)

资料显示，我国镁矿行业自律联合行动初见成效。自4月9日由13家镁砂企业在大连联合组成嘉源镁砂出口集团以来，我国镁砂市场价格有了较快回升，到目前，重烧镁的国家市场价格已由最低时的85美元上升到116美元。

镁砂是不可再生的资源性产品，我国辽宁南部一带是世界上优质镁砂的重要产地。但近年来，由于一些企业低价竞销，导致我国镁砂出口价格严重下滑。为扭转这一局面，我国镁砂行业龙头企业海城市后英镁砂集团、海城市西洋耐火材料公司、营华晨集团有限公司、辽宁对外贸易总公司、大连金阳进出口公司等13家跨地区、跨所有制企业，联合组成嘉源镁砂出口集团，以统一经营、统一报价、统一签约、统一办理各项手续的形式参与国际竞争。现在外商不仅踊跃订货，而且还交付定金和保证金，大大减少了我国镁砂企业的销售风险。镁砂国际市场的回暖，也带动了国内镁砂企业的发展，原来停产的一些镁砂企业纷纷恢复生产，许多失业工人又重新回到了岗位。

嘉源镁砂出口集团董事局首席执行官孙寿宽认为，联合行动的成功，是在我国有关部门的大力支持和现行政策稳定的情况下取得的。如果实施得好，可使国家在没有增加任何投入的情况下，每年能多收入5000多万美元的外汇，国家有限的资源可以得到很好的保护。但他同时表示，参与联合的企业承担着很大的风险，而且承受很大困难。他希望国家有关政策在较长一段时间内能保持连续性和稳定性，以使这一有效措施发挥更大的作用，使我国镁砂企业在国际市场具有更强的竞争力。镁砂出口价格回暖，也使地方财政受益。





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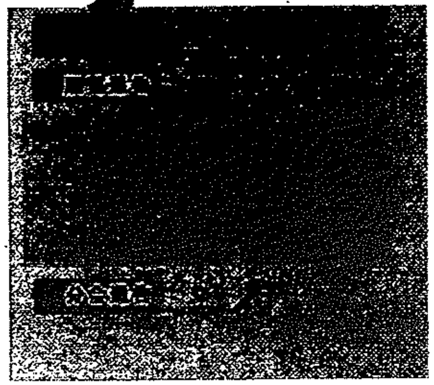

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ORGANIZATIONAL & COMMUNICATIONAL ENGINEERING

OCE Translations

1 March 2006

Certificate of Accuracy

I, Aaron Mendelson, project manager at OCE Translations Network, hereby certify that the foregoing translation from Chinese into English, attached hereto and consisting of 1 page, is a true and correct translation of the original document.

Aaron Mendelson

State of NC
County of Guilford

Sworn to and subscribed before me this 1st day of March, 2006.

Notary Public

My commission expires: 6/24/06

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United States
606 Mayflower Drive
Greensboro, NC 27403
Tel: +1-336-272-3540
usa@oce-translations.com

Canada
33 Major Wm. Sharpe Drive
Brampton, ON L6X 3J3
Tel: +1-905-456-8159
canada@oce-translations.cor

Europe
Rue des Trois Rois 5
4607 Dalhem BELGIUM
Tel: +32-(0)70-222-705
europe@oce-translations.con

Asia Pacific
Suite 205, Block 3
Qing Quan Ya Yun Li Du Gard
Dongguan City 523565, CHI
Tel: +86-769-375-4989
asia@oce-translations.com

ANIMAL SCIENCE PRODUCTS, INC., et al.,

Plaintiffs,

v.

CHINA NATIONAL METALS & MINERALS IMPORT & EXPORT CORPORATION, et al.,

Defendants.

Civil Action No. 05-4376 (GEB)

DECLARATION OF JENNIFER MILICI

I, Jennifer Milici, do hereby state and declare as follows:

1. I am an associate with the law firm Boies, Schiller & Flexner LLP, 5301 Wisconsin Avenue, NW, Suite 800, Washington D.C. 20015. I have personal knowledge of the facts set forth herein.

2. The attached is a true and correct copy of an article printed from the website of the China Chamber of Commerce of Metals Minerals & Chemicals Importers and Exporters on September 7, 2005.

I declare under penalty of perjury that the foregoing is true and correct.

Jennifer Milici

Dated: March 30, 2009

4/2/01 Indus. Min. 7
2001 WLNR 590946

Industrial Minerals

April 2, 2001

Issue 403

And then there was one: China's latest magnesia export group.

Liaoning Jiayi Industrial Development Co Ltd spearheaded the formation of a new single unified group to take the place of two previous separate groups designed to control China's magnesite prices and exports. The new group aims to provide strict management control of all sales, production schedules of individual producers and export prices for Chinese magnesite. The group believes that encouraging individual producers to produce as much as their respective export licence quotas will shield the sector from the impact of a recession such as intense competition and anti-dumping duties. Other objectives of the union include providing price bargaining power as a group and gaining support from the government. However, confusions on the group's name and as to its members have also been reported. Some refer the new group as either Liaoning Magnesia Import &Export or China Magnesite Export Association. Other observers are also skeptical as to the capability of the group's leaders to convince union members to forego potential individual profit for the sake of the union. In addition, Liaoning Jiayi Industrial has obtained export licences of 146,378 tonnes under agreement bidding for 2001.

---- INDEX REFERENCES ----

REGION: (China (1CH15); Asia (1AS61); Eastern Asia (1EA61))

Language: EN

OTHER INDEXING: (CHINA MAGNESITE EXPORT ASSOCIATION; LIAONING JIAYI INDUSTRIAL; LIAONING JIAYI INDUSTRIAL DEVELOPMENT CO; LIAONING MAGNESIA IMPORT) (Metals Industries (MS-12)) (market ; company structure ; trade) (China (4011))

COMPANY TERMS: LIAONING JIAYI INDUSTRIAL DEVELOPMENT

SUBSTANCE TERMS: ((magnesia) (Inorganic Chemicals NEC) (2819)) (1309-48-4)

Word Count: 239
4/2/01 INDUSMIN 7
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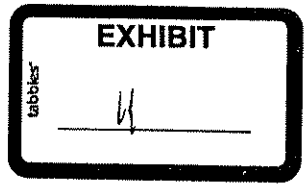


METAL - PAGES

Wednesday 15 August 2001

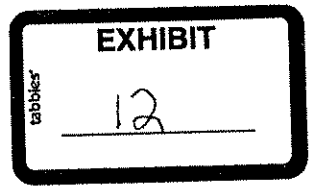
Chinese Export Association holds DBM prices steady

LONDON (Metal-Pages) 15-Aug-01. The changing nature of the dead burned magnesite trade from China has been taking shape for some eighteen months now following the mid 2000 formation of the Jiayuan Magnesite Export Group and the Huaxia Magnesium Products Export Group. Today, the net effect of the formation of the two export groups - conceived with the target of restructuring the domestic industry and improving long term profitability â€" and their subsequent merger in April of this year into the China Magnesium Export Association, has been stability. CMEA's main aim has been to unify the export sales and prices and to co-ordinate the use of licences and production and the result over recent months has been half a year of stable prices.

Initially, the group set a new standard price for 95% MgO magnesite of $140/tonne, with other levels set for other grades ranging from $114/tonne for 90% MgO to $160/tonne for 97% MgO. However, market prices appear to have bumped along $3-10 below the standards set, varying according to the customer.

Currently, dead burned magnesite prices are static, and are $130-138 per tonne for 95% MgO material, FOB China, in a quiet market. Prices lifted slightly at the beginning of the year to the top end of the range and were around $135-138/tonne. Today, prices are spread, with most trading in the $130-135 bracket. One trader at least is anticipating that prices might drift gently downwards over the next two to three months as demand declines, particularly in the USA and Far Eastern markets.

The Chinese Magnesite Export Association is made up of 23 Chinese traders and producers and so far the group has acted in unity. However, there is oversupply at the moment and demand is dropping as the steel industries of North America and the Far East decline. As the economic conditions toughen and purchase orders not easy to come by, it remains to be seen whether the new group will continue to be able to persuade its members to forego their individual profit for the common good. If past performance is anything to go by, itâ€™s a risky bet.



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Mining Annual Review

October, 2001

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BYLINE: By Brian Coope, Industrial Minerals Consultant, 33 Richmond Park Road, London, SW14 8JU, UK, Tel: +44 (0)20 8876 2197, Fax: +44 (0)20 8876 0884, E-mail: briancoope@compuserve.com.

BODY:

The past year has been a surprisingly good one for the magnesia industry. The long-suffering refractory magnesia sector experienced an upsurge in demand and prices improved during the year. Stronger demand was primarily in response to the strong performance of the world's steel industry in 2000 and the subsequent increased demand for magnesia-based refractories. World steel output reached a record 847 Mt after a five-year period stuck in the 750-800 Mt range and overall levels have been maintained in the March quarter of 2001 with reduced production in North America balanced by growth elsewhere.

World magnesia markets continue to be influenced by events in China but for once some of these developments may be beneficial to Western producers and Chinese producers alike. The new unified Chinese magnesite/magnesia exporters group may be the vehicle with enough power to take the road out of the trade dispute quagmire. A process of concentration, consolidation and rationalisation has been taking place within both the magnesia industry and its main customer, the refractories industry, and has led to improved financial performance for many of the main players.

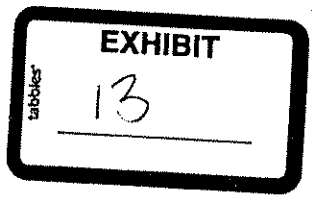
The emergence of RHI of Austria, Cookson of the UK, and Wulfrath of Germany as the three world basic refractory majors has had a marked effect on the magnesia market. RHI is a major producer of refractory magnesia through operations in Austria, Turkey and the US and is also the world's largest manufacturer of magnesia-based refractories through operations in Austria, Germany, the US, China, and elsewhere.

The Cookson Group and its Vesuvius division became a major magnesia producer in 1999 when it acquired Premier Refractories from the Alpine group but is now in the process of shedding the magnesia-producing assets -- which in any case are now mainly focused on non-refractory magnesia markets.

Meanwhile, the third major basic refractories grouping emerged through the merger between Wulfrath of Germany (now owned by the Lhoist Group of Belgium) and Baker Refractories of the US. The roots of both companies were in the manufacture of dolomite-based refractories but the new combined enterprise will be a major producer of magnesia-based refractories in Europe and North America. In recent years Baker Refractories has maintained a strategic alliance with the Australia magnesia producer, QMag.

Prices improved after several years of decline and a number of refractories companies with magnesia and magnesia refractories interests have reported much improved financial performance. At the same time the number of refractories companies operating has diminished considerably through merger and acquisition activity.

Many magnesia producers have sought deliverance from refractories decline in non-refractory magnesia markets, where growth prospects are higher and where the influence of low-priced Chinese magnesia is less of a problem. Notable growth sectors include environmental applications for magnesia and magnesium hydroxide -- particularly water and waste treatment - and the magnesium metal market for natural magnesite.



China

China continues to dominate the world magnesia market, accounting for over 40% of world production for both dead-burned magnesia (DBM) and caustic-calcined magnesia (CCM) and over 80% of electrofused magnesia production. China's total magnesia production is currently estimated to be of the order of 3.5 Mt/y -- with an approximate split of around 2.4 Mt/y DBM, 650,000 t/y CCM and 450,000 t/y EFM. Exports for the past three years have totalled around 2.1 Mt/y -- 1.2-1.4 Mt DBM, 500,000 t/y CCM, and 250,000 t/y EFM.

One of the major developments over the past year has been the formation of a powerful magnesite exporters' group -- the Chinese Magnesite Export Association (CMEA). The process began with the formation of two groups in early 2000 - Jiayuan Magnesite Export Group and Huaxia Magnesia Products Export Group -- and was prompted by the dissatisfaction of major producers at the low price regime forced on them by traders. The two groups were able to effect price rises of around US$ 10/t during 2000 and further rises have been experienced in 2001. The CMEA was formally established in February 2001 and involves 23 companies including major players such as: Yingkou Qinghua, Huaziyu, Haicheng Xiyang, Haicheng Houying, Haicheng Pailou and Yingkou Huacheng.

Russia

Russia's magnesite, magnesia and basic refractories giant is Kombinat Magnezit with its operations at Satka, near Chelyabinsk in the southern Urals. The company has total burning capacity of over 2 Mt/y. Current levels of output are thought to be of the order of 2.5 Mt/y of beneficiated raw magnesite and 1.1 Mt/y of magnesia grain and powders, a large proportion of which is processed in basic brick and other refractory products.

Closures

The past two years have seen a number of closures of uneconomic magnesia operations -- in the US (National Refractories), Italy (Seamag), the Slovak Republic (Magnatech), India (Birla Periclase) and Japan (Asahi Glass).

The latest closure concerns the National Refractories & Minerals seawater magnesia plant at Moss Landing in California. In the past the plant had produced 150,000 t/y of refractory magnesia but in recent years has been more focused on the supply of magnesium hydroxide for environmental markets.

Magnatech was the company set up to operate the Hacava plant which had formerly been part of the state enterprise, Slovenska Magnezit Zavody. The plant used a chemical beneficiation technique to produce a very pure grade of magnesia from high iron natural magnesite. The product quality was excellent but the operating costs were too high.

Seamag was a company that set out to revive the original Sardamag plant at Sant' Antioco in Sardinia, Italy. Despite an engineering overhaul and revamp the plant was unable to make an impression on the market.

Birla Periclase was the seawater magnesia plant set up in India by Indian Rayon Industries. However, it was unable to operate at a profit in competition with Chinese EFM and closed in 1999 after operating for little over one year.

World Production of Natural Magnesite ('000 t)

	1998	1999	2000
Australia	379	367	380
Austria	650	650	550
Brazil	1,200	1,100	1,100
Canada	200	200	200
China	8,500	8,500	9,000
Greece	650	650	620
India	355	360	360
North Korea	800	800	650
Russia	2,200	2,400	2,500
Serbia	60	50	50
Slovakia	878	850	800
Spain	500	500	500
Turkey	1,600	1,500	1,400

	1998	1999	2000
Others *	200	200	200
World Total	18,172	18,127	18,310

* Inc. the US, Colombia, South Africa, Zimbabwe, Poland, Pakistan, and Iran

Source: USGS, British Geological Survey, and author's estimates

Rationalisations

During the 1970s three of the world's largest seawater and brine magnesia operations were: Ube in Japan, Britmag in the UK and Martin Marietta in the US. Combined capacity of these plants once stood at over 900,000 t/y but major rationalisation programmes have been carried out with reductions to effective capacity and changes to product lines.

New Production

Later this year Jordan Magnesia Co. is scheduled to begin production of magnesia from Dead Sea brines at plant. The plant will use magnesium chloride brines produced as a by-product of potash processing operations from the operations of its parent company, Arab Potash Co., and 50,000 t/y of DBM and 10,000 t/y of CCM is planned. Early in 2001 the company concluded a marketing and sales agreement with the Possehl group of Germany.

In Western Australia, Westmag announced plans to construct a 50,000 t/y magnesia plant at Port Hedland using magnesium chloride from salt bitterns which will be converted to magnesium hydroxide and magnesia using local dolomite.

Mergers and Acquisitions in Magnesia

During 2000 the Austrian producer Styromag (Steirische Magnesit Industrie) acquired Comag of Turkey, that country's leading producer and exporter of caustic calcined magnesia. Comag operates quarries and a plant at Tavsanli in the Eskisehir district of western Anatolia to produce 45,000 t/y of low-iron CCM for use in producing fused magnesia and construction products. Styromag has a similar-sized plant at Oberdorf, near Graz in Austria, producing higher-iron grades for animal feeds and construction applications.

Grecian Magnesite SA of Greece increased its influence as one of Europe's leading suppliers of DBM and CCM by taking over the Spanish company, Magnesitas Navarras (Magna), in an alliance with Timab Industries of France. Magna produces up to 125,000 t/y of DBM and CCM and also operates a plant to produce refractory masses.

The US fused magnesia producer Minco has re-emerged as an independent company after spending a short period as a member of the English China Clays group. The company was acquired by ECC in 1998 but was part of an enforced divestiture of assets when ECC was itself taken over by Imerys in 1999. The company was bought by a group of independent investors in August 2000. The company's plant at Midway, Tennessee, has a capacity to produce fused magnesia and fused silica of about 25,000 t/y. The company is one of four major companies producing electrical grades of fused magnesia. The others are the UCM Group with operations in the UK and US, Tateho Chemical Industries of Japan, and TSL of the UK (part of the Saint Gobain group of France).

In 2000 RHI (Radex Heraklith Industriebeteilgungs AG) of Austria completed the acquisition of Harbison Walker Refractories (Global Industrial Technologies) for US$500 million. Existing RHI businesses in North America included North American Refractories (Narco), VRD-Canada Inc., Tri-Star Refractories Inc., Intertex Inc, and Zircoa. All plants will now operate under the name of RHI Refractories America.

Meanwhile, Cookson Group plc sold its US magnesia business -- which came with the acquisition of Premier Refractories -- to Premier Chemicals. These are two locations -- the magnesite mine and plant at Gabbs, Nevada (140,000 t/y CCM) and the seawater magnesia operation at Port St Joe, Florida (75,000 t/y CCM and 45,000 t/y magnesium hydroxide). The new company was set up by a team including members of the former management of Premier Refractories.

Martin Marietta is selling its refractories business to Minteq, the refractories arm of Mineral Technologies, which is a world leader in basic monolithic refractories. MM will retain the Manistee, Michigan plant, which will continue to

produce refractory magnesia for Minteq products but MM will now concentrate on the production and sale of magnesium hydroxide and chemical magnesias.

Magnesium Metal

At present only 200,000 t/y of natural magnesite is consumed in the production of magnesium metal -- at the 43,000 t/y plant of Norsk Hydro at Becancour, Quebec, Canada. The plant has been based predominantly on raw magnesite imported from China although more recently shipments of raw magnesite form Australia and Spain have been made to the plant.

By 2004 the magnesite required for magnesium metal production could rise by a further 600,000 t/y as two magnesite-based projects in Australia are set to leave the blocks this year with a combined capacity of 140,000 t/y of magnesium metal. The new plants will be operated by Australian Magnesium Corp., (part of the Normandy group) at Stanwell in Queensland and by Samag (owned by Pima Mining) at Port Pirie in South Australia.

World Magnesite and Magnesia Production 2000

Country	Magnesite	Magnesia	Companies
	Natural --	from Natural Magnesite	
Australia	380	155	QMag
Austria	550	350	Radex
Brazil	1,100	350	Magnesita
Canada	270	90	Baymag
China	9,000	3,500	Liaoning Mag, Pailou, Xiyang, Qinhua
Greece	620	150	Grecian Magnesite
India	360	100	Dalmia, Burn Std, Tanmag, Almora
North Korea	650	180	NK Magnesite
Russia	3,000	1,100	Magnezit Satka
Slovakia	800	270	Slovmag Lubenik, SMZ Jelsava,
Spain	500	170	Mag Navarras, Mag Rubian
Turkey	1,400	345	Kumas, Manyezit, Comag
Others	320	110	Includes the US, Iran, Poland, S Africa
Total Natural	18,950	6,870	
	Synthetic --	from Seawater and Brines	
UK		85	Britmag
Ireland		70	PremierPericlase
Netherlands		150	Nedmag
Italy		80	Sardamag/Cogema
Norway		15	NorskHydro
Israel		95	DeadSeaPericlase
US		360	MMarietta, RHI, NatRef, Premier
Mexico		85	QuimicadelRey, Mexico
Japan		150	Ube
SKorea		50	SamHwa
Total Synthetic		1,140	
Total Magnesia		8,010	

World Magnesia Prices - US$ /t cif Europe

		May 1999	May 2000	May 2001
Dead-burned	First grade DBM1	240-350	200-300	180-220
	Chinese 94-95% MgO	115-125	130-150	115-135

		May 1999	May 2000	May 2001
	Chinese 90-92% Mg	110	120-130	105-120
Caustic	Industrial	280-320	300-375	180-220
	Agricultural	100-140	110-140	100-120
Electrofused	EFM1 (Australia, Canada)	550-600	600-800	700-800
	Chinese 97-98	350-500	350-500	320-350
	Chinese 95-96	250-325	270-330	290-350

Source: *Industrial Minerals*, author's estimates.

LOAD-DATE: October 20, 2001

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2003 WLNR 666749

Industrial Minerals

April 1, 2003

Issue 427

New Chinese magnesia export group formed prices rise.

The new Chinese Magnesia Export Association (CMEA) has reported floor price rate for exports some $10-15 higher than market prices of the previous quarter 2002. The escalating costs of magnesia production including the rising prices for fuel oil, electricity and coke are prompting producers to raise their export prices. The following are all FOB Bayuquan, bulk: DBM97 $160/tonne, DBM96 $155/tonne, DBM95 $142/tonne, DBM9460 $137/tonne, DBMM9010 $115/tonne and DBM9001 $105/tonne. The new group reportedly controls approximately 70% of **Chinas magnesite** export licences, which total just under 780,000 tonnes for 2003.

---- INDEX REFERENCES ----

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OTHER INDEXING: (CHINESE MAGNESIA EXPORT ASSOCIATION; CMEA) (Raw material winning (MS-10)) (trade) (China (4011))

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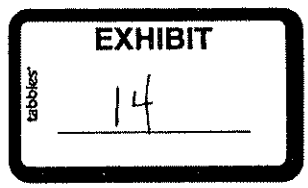

UNITED STATES
INTERNATIONAL TRADE COMMISSION

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Date: September 23, 2003

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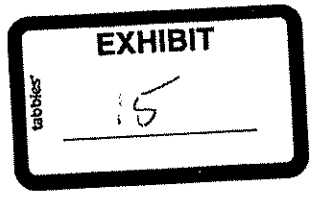

THE UNITED STATES INTERNATIONAL TRADE COMMISSION

In the Matter of:	)	
	)	Investigation No.:
REFINED BROWN ALUMINUM	)	731-TA-1022 (Final)
OXIDE FROM CHINA	)	

Tuesday,
September 23, 2003

Room No. 101
U.S. International Trade Commission
500 E Street, S.W.
Washington, D.C.

The hearing commenced, pursuant to notice, at 9:31 a.m., before the Commissioners of the United States International Trade Commission, the Honorable DEANNA TANNER OKUN, Chairman, presiding.

APPEARANCES:

On behalf of the International Trade Commission:

Commissioners:

DEANNA TANNER OKUN, CHAIRMAN
JENNIFER A. HILLMAN, VICE CHAIRMAN
MARCIA E. MILLER, COMMISSIONER
STEPHEN KOPLAN, COMMISSIONER
CHARLOTTE R. LANE, COMMISSIONER

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MARILYN R. ABBOTT, THE SECRETARY
DEBORAH A. DANIELS, LEGAL DOCUMENTS ASSISTANT
JAMES MCCLURE, SUPERVISORY INVESTIGATOR & INVESTIGATOR
PETER SULTAN, ATTORNEY
AMELIA PREECE, ECONOMIST
JUSTIN JEE, ACCOUNTANT

CHAIRMAN OKUN: Thank you.

MR. O'BRIEN: Our next speaker is Mr. Liu.

MR. JIANWEI: Good afternoon. My name is Liu Jianwei and I am the head of Legal Services Department of China Chamber of Commerce of Metals, Minerals and Chemicals, Importers & Exporters. The CCCMC is a non-government organization under the current market economy system in China. It acts as a trade coordinator, providing services to its members and services as a bridge between the government and its members.

CCCMC has over 2600 members. Of this number, approximately 200 are producers of brown fused alumina. Of this number, 150 are also exporters. Although there are one or two state-owned companies, all of the producers and exporters set their prices according to the market competition.

2003/ March 24th
http://www.cccmc.org.cn

Magnesite Export Industry Self-regulatory Group – The China Magnesite Forum

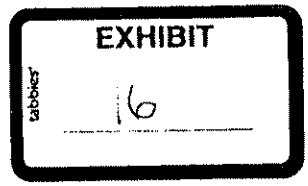
On March 22nd, 19 major enterprises from the Magnesite export industry held a meeting in Shenyang to thoroughly review and analyze the Magnesite export industry since its induction a year ago, to discuss and forecast the international market demand and price trend for the year 2003.

The group agreed that the most important topics of discussion for now and the near future were : how to strengthen self-regulation and cooperation in the industry, act against improper competition and uphold normal and orderly export procedures within the established framework of quota tender policy.

After much discussion and exchange of ideas, the group agreed to the immediate setting up of the Magnesite Export Industry Self-regulating Group in the form of the "China Magnesite Forum". The Forum will accept arbitration and guidance from the China Chamber of Commerce of Metal, Minerals & Chemicals Importers & Exporters, establish standards for export behaviors, protect the interest of the country, the industry, and legal interests of its members against improper competition, encourage healthy development of the magnesite products industry.

19 participating enterprises of the forum were (not in any order) :

Liaoning Jiayi Metal & Minerals Ltd Company, Haicheng Houyin Trading Group, Haicheng Hua Yu Group Import & Export Ltd Company, Haicheng Xiyang Import & Export Company, Yingkou Huacheng Group Ltd Company, China National Metals & Minerals Import & Export Head Office, China National Minerals Import & Export Ltd Company, Liaoning Huiming International Trading Ltd Company, Dalian Golden Sun Import & Export Ltd Company, China Metallurgical Import & Export Corporation, Haicheng Zhishen Magnesium Products Ltd Company, Haicheng Xingliao Refractory Materials Ltd Company, Haicheng Chunhao Refractory Materials Ltd Company, Heilongjiang Jincheng Ltd Company, Liaoning Qunxing Magnesium Products Ltd Company, Haicheng Jinyahai High Quality Magnesite Ltd Company, Yingkou Huacheng Import & Export Ltd Company, Yingkou Huacheng High Quality Fire Resistant Material Ltd Company, Donggang Dongxin Magnesium Products Manufacturer.



OCE Translations

609 Mayflower Drive
Greensboro, NC 27403, USA
(+1)-336-272-3557
(+1) 775-890-3643
usa@oce-translations.com
www.oce-translations.com

10 November 2005

Certificate of Accuracy

I, Martin Heimann, project manager at OCE Translations LLC, hereby certify that the foregoing translation from Chinese into English, attached hereto and consisting of 1 page, is a true and correct translation of the original document.

Martin Heimann

State of NC
County of Guilford

Sworn to and subscribed before me this 10th day of November, 2005.

Notary Public

My commission expires: 12-4-2008

JUANITA MEAD KASIAH NOTARY PUBLIC My Comm. Expires Dec. 11, 2008 GUILFORD COUNTY, NC

中国五矿化工进出口商会

镁砂出口行业自律性组织—中国镁砂论坛成立

3月22日，镁砂出口行业的19家主营企业在沈阳召开会议，对入世一年来的镁砂出口情况进行了全面回顾与分析，对2003年的国际市场需求和价格走势进行了充分讨论和估计。会议认为，如何在巩固配额招标改革成果的基础上加强行业自律协调，反对不正当竞争，维护正常的镁砂出口经营秩序是当前及今后一段时间的重要课题。经过广泛的求证，会议决定从即日起成立镁砂出口行业自律性组织—"中国镁砂论坛"。论坛接受中国五矿化工进出口商会的协调、指导，自觉规范成员的出口经营行为，维护国家利益、行业利益和成员的合法权益，反对不正当竞争，促进镁制品行业的健康发展。

参加"中国镁砂论坛"的企业有（排名不分先后）：辽宁海益五金矿产有限公司、海城市前英经贸集团有限公司、海城东洋集团有限公司、海城东洋进出口公司、营口华晨集团有限公司、中国五金矿产进出口总公司、中国矿产进出口有限责任公司辽宁机械国际贸易有限公司、大连金冠进出口有限公司、中国冶金进出口总公司、海城耐火镁制品有限公司、海城兴辽宁火材料有限公司、海城春游宁火材料有限公司、黑龙江金城实业有限公司、辽宁群兴镁制品有限公司、海城金亚海鸟牌镁砂有限公司、营口华晨进出口有限公司、营口华晨高级宁火材料有限公司、东港东新镁制品厂等19家镁砂出口企业。

100 年 3月 22日

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW JERSEY

ANIMAL SCIENCE PRODUCTS, INC., et al.,

Civil Action No. 05-4376 (HAA/ES)

Plaintiffs,

v.

CHINA NATIONAL METALS & MINERALS IMPORT & EXPORT CORPORATION, et al.,

Defendants.

DECLARATION OF JENNIFER MILICI

I, Jennifer Milici, do hereby state and declare as follows:

1. I am an associate with Boies, Schiller & Flexner LLP in Washington, D.C. I am competent to testify to the matters stated herein, have personal knowledge of the facts and statements in this declaration, and each of the facts and statements is true and correct to the best of my knowledge.

2. I am making this Declaration to describe the procedures I employed to capture information electronically stored by the China Chamber of Commerce of Metals, Minerals & Chemicals Importers & Exporters on March 30, 2009, on its website located at www.cccmc.org.

3. The information captured was located at the specific URL http://www.cccmc.org.cn/WebApp/ENet_DefaltUsed/Systems/Publish/ShowFile/Show_CheckRight.aspx?queryStr_z8w8q7x16q7p2x1X19o3w8w1v3v1vVV7zO3w8w1v1v7zO3x10x02x11p4x

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4. The information that I captured from the website of the China Chamber of Commerce of Metals, Minerals & Chemicals Importers & Exporters was publicly available on the Internet. The website was freely accessible by the general public, and the information as captured is presented exactly as was displayed as of 1 p.m. (EST) on March 30, 2009. The website was displayed in Chinese, requiring that visitors using Microsoft Internet Explorer have the "Chinese Simple" language pack installed in their browser to properly view the website.

5. Using Internet Explorer, I accessed the above specific URL and saved the page in an MHT format file.

6. I affirm that the attached document is an accurate representation of the file accessed on the website of the China Chamber of Commerce of Metals Minerals & Chemicals Importers & Exporters on March 30, 2009.

I declare under penalty of perjury that the foregoing is true and correct.

Jennifer Milici

Dated: March 30, 2009

MAGNESIUM COMPOUNDS

By Deborah A. Kramer

Domestic survey data and tables were prepared by Oana Petrican, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Production of most magnesium compounds in 2004 was lower than that in 2003, reflecting the effects of the loss of a magnesium hydroxide producer and a dead-burned magnesia producer for the full year. Dead-burned magnesia consumption, however, increased as imports from China continued to supply most of the U.S. demand. For dead-burned magnesia, net imports (imports minus exports) supplied most of U.S. consumption. Caustic-calcined magnesia production fell by about 15% from that in 2003, but consumption was only about 6% lower. Net imports of caustic-calcined magnesia supplied about 53% of domestic demand.

About 51% of U.S. magnesium compounds production came from seawater and well and lake brines. The remainder was recovered from brucite, dolomite, magnesite, and olivine. About 58% of the total consumption of magnesium compounds was for refractory applications. The remaining 42% was used in agricultural, chemical, environmental, and other applications. China remained the dominant supplier of imports for refractory and caustic-calcined magnesias with 82% and 61%, respectively, of the totals.

Production

With the exception of magnesium sulfate, production of all magnesium compounds in the United States declined from 2003 to 2004 (table 3). The drop in production reflected the effects of the first full year of closure of Dow Chemical Co.'s Ludington, MI, plant that produced magnesium hydroxide for refractory and environmental applications. In addition, Rohm and Haas Inc. stopped producing magnesium carbonate in 2003 and was shipping from stocks in 2004.

Data for magnesium compounds were collected by the U.S. Geological Survey from one voluntary survey of U.S. operations. Of the 16 operations canvassed, 88% responded, representing 76% of the magnesium compounds shipped and used, including some data not reportable in table 3. Data for the two nonrespondents were estimated on the basis of prior-year consumption levels and other factors.

The largest capacity magnesite production facilities in the world are in China, North Korea, and Russia. Together, these three countries account for two-thirds of the world's magnesite production capacity. Japan and the United States account for about one-half of the world's magnesium compounds production capacity from seawater or brines. Fused magnesia is produced in Australia, Brazil, Canada, China, Israel, Japan, the Republic of Korea, Mexico, Russia, the United Kingdom, and the United States. World production capacity is estimated to be about 650,000 metric tons per year (t/yr), including about 500,000 t/yr of capacity in China.

Fused magnesia was produced by two companies in the United States: Newminco Inc. with a plant in Midway, TN, and UCM Group PLC of the United Kingdom, which operated a plant in Cherokee, AL, through its Muscle Shoals Minerals Inc. subsidiary.

Norway is the world's principal producer and supplier of olivine. Other producers include Australia, Austria, Brazil, China, Italy, Japan, the Republic of Korea, Mexico, Spain, Taiwan, Turkey, and the United States. Rudi (2001) estimated that total world production of olivine averaged about 4 million metric tons per year (Mt/yr), with about 3.3 Mt/yr consumed in Europe. An additional 4 Mt/yr of dunite and serpentinite that is often commercially called olivine is produced.

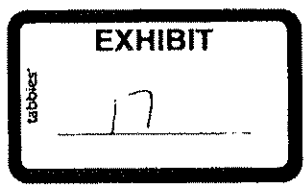
Two companies in the United States produced olivine—Unimin Corp. and Olivine Corp. Unimin operated two mines, one in North Carolina and one in Washington, and processing plants in Indiana, North Carolina, and Washington. Olivine operated one mine and one processing plant in Washington.

In February, Reilly Industries Inc. agreed to sell its potash and brine business, which included its Wendover, UT, brine facility, to Intrepid Mining LLC. Reilly produced potash and magnesium chloride brine at the Wendover plant, and Intrepid Mining expected to continue production of these products. Intrepid installed a new deep brine well that would provide brine from an additional aquifer to augment production (Green Markets, 2004).

Martin Marietta Magnesia Specialties LLC announced that it would increase production capacity for high-surface-area magnesium oxide at its plant in Manistee, MI. After the expansion, total capacity would be about 1,100 t/yr. The high-surface area product is used in flame-retardant applications (Industrial Minerals, 2004c). Martin Marietta also introduced its Celiguard™ magnesium hydroxide product for use in paper mills and licensed the rights to its Thioguard™ product for use in sewage systems in certain areas of the Midwest (Martin Marietta Materials Inc., 2005§[1]).

J.P. Morgan Partners LLC, the private equity arm of J.P. Morgan Chase & Co., announced that it would acquire the privately held PQ Corp., one of the leading U.S. producers of magnesium sulfate. The terms were not disclosed. The sale was subject to approval by PQ's shareholders, which included descendants of Joseph Elkinton, who started the company in 1831, and current and retired management. The transaction was expected to close in the first quarter of 2005 (Chemical Week Newswire, 2004§).

[1]References that include a section mark (§) are found in the Internet References Cited section



Consumption

In 2004, environmental applications (water treatment and stack gas scrubbing, in descending order) was the largest tonnage end use for caustic-calcined magnesia, with 41% of the total, and chemical intermediates was second with 35% of the total. The following categories, with the individual components in descending order of consumption in parentheses, were the other end-use sectors for caustic-calcined magnesia: agriculture (animal feed and fertilizers), 20%; construction (primarily oxychloride and oxysulfate cements), 3%; manufacturing (rubber, fuel additives, and electrical), 1%; pharmaceuticals and nutrition (medicine and pharmaceuticals and cosmetics), less than 1%; and unspecified uses, less than 1%.

Magnesium carbonate was used principally in medicines and pharmaceuticals and as a chemical intermediate (uses are given in descending order of quantity). Magnesium hydroxide was used mainly for water treatment, as a chemical intermediate, and in medicines and pharmaceuticals. Smaller applications for magnesium hydroxide were in the construction industry and in rubber processing. Magnesium sulfate was used mostly for chemical, fertilizer, pulp and paper, rubber, and pharmaceutical applications. Magnesium chloride was used mainly for ice control and in medicines and pharmaceuticals. Magnesium chloride brines were used principally for road dust and ice control and as a chemical intermediate.

Foundry uses remained the leading application for olivine in the United States, accounting for 91% of consumption of domestically produced material. Sandblasting and other abrasive uses accounted for 5% of U.S. consumption, and refractory applications accounted for 4%.

Prices

Quoted prices for magnesium oxide and magnesium hydroxide increased slightly from those at yearend 2003, and other magnesium compounds prices remained at the same level (table 4). Press reports indicated that several U.S. producers raised prices during 2004 because of increased natural gas and freight costs. Martin Marietta Specialties Magnesia increased its prices for magnesium hydroxide by 6% at the beginning of 2004 and announced a 5% increase on its caustic-calcined magnesia products in July. Premier Chemicals LLC increased its magnesium oxide and magnesium hydroxide prices at the beginning of 2004 by 4%. Premier Chemicals also introduced freight and energy surcharges (O'Driscoll, 2004b).

Foreign Trade

Exports of dead-burned and caustic-calcined magnesia from the United States both fell from the level in 2003 (table 5). Dead-burned magnesia exports dropped by 47%. Canada (78%) was the principal destination. Caustic-calcined magnesia exports were 8% less than those in 2003. The Netherlands (36%) and France (35%) were the main destinations.

Imports of dead-burned magnesia increased by about 10% from those in 2003, with imports from China representing 82% of the total (table 7). Imports of caustic-calcined magnesia were about 5% higher than those in 2003. China (61%) and Canada (35%) were the primary sources.

Trade data for olivine are not available separately from the U.S. Census Bureau. The Journal of Commerce Port Import/Export Reporting Service (PIERS), however, provides data on material that travels by ship. U.S. exports of olivine in 2004 were 1,710 metric tons (t), with 83% of the material shipped to Argentina. U.S. olivine imports totaled 95,200 t, a 56% decrease from the high level in 2003. Norway was the source of almost all (99.9%) U.S. olivine imports.

World Review

European Union.—The European Commission began an investigation into dumping of magnesia-carbon refractory bricks from China into the European Union (EU). The suit was filed by the European Refractory Producers Association, which represents 15 refractory producers with more than 50% of the EU's magnesite brick production. The suit alleged that imports of magnesia bricks from China have increased and have had an adverse impact on the quantities and prices of bricks sold by the EU producers. The investigation was expected to be completed by September 2005 (Industrial Minerals, 2004b).

Australia.—Australian Magnesium Corp. (AMC) sold its Queensland Magnesium Corp. (QMAG) subsidiary on December 1, 2004. QMAG and all remaining rights to magnesite deposits were sold to Resource Capital Fund III L.P. (RCF) for $5.8 million and assumption of the $42.5 million debt to ANZ Banking Group Ltd. In return for being released by ANZ as a guarantor of the facility, Newmont Mining Corp. will provide a loan of $21.8 million to RCF and forgive AMC's debts of $5.6 million. RCF was expected to invest in QMAG to increase production capacity to 100,000 t/yr and improve the efficiency at the company's Kunwarara mine beginning in 2005 (Industrial Minerals, 2004a).

China.—In February, another magnesite export syndicate was formed in China—the China Magnesite Self-Disciplined Association. This is the fifth version of a group that was established to regulate magnesite exports and prices since 2000. The new group represents five of the leading Chinese magnesite producers, and its goal was to maintain dead-burned magnesite prices in a range between $152 per metric ton for 90.0% magnesium oxide and $210 per ton for 97.3% magnesium oxide (Industrial Minerals, 2004f).

Because of increasing prices in China for fuel coke and increasing freight costs, magnesia prices rose substantially during the first part of 2004. In January, 94% magnesium oxide caustic-calcined magnesia prices were reported to be $108 to $110 per ton, but by July, this price range had increased to $165 to $185 per ton (O'Driscoll, 2004b).

Greenland. Sweden's Minelco AB [a subsidiary of Luossavaara-Kiirunavaara Aktiebolag (LKAB)] continued to develop the Seqi olivine project. In June, the LKAB board of directors authorized Minelco to proceed with the commercial arrangements with the owner of the deposit, Crew Development Ltd., and to begin production. As a result, Seqi Olivine A/S was formed as an operating company that will be jointly owned by Minelco (51%) and Crew Development (49%). The company submitted an application to the Greenland authorities for sample testing, and based on the normal approval process time, the mine was expected to be operational by the second half of 2005. The mine was designed for all year operation, with a production capacity of 1.7 Mt/yr (O'Driscoll, 2004a).

Jordan. Jordan Magnesia Co. inaugurated the dead-burned magnesia section of its new 60,000-t/yr magnesia plant in March. Dead burned magnesia capacity is 50,000 t/yr; the remaining capacity can produce caustic calcined magnesium and magnesium hydroxide (Industrial Minerals, 2004d). In December, however, the plant stopped production for scheduled maintenance, and the company encountered some technical problems, so the plant remained closed at yearend. No startup date was announced (O'Driscoll, 2005).

Netherlands. Greek magnesite producer Grecian Magnesite SA opened a new branch operation in Vlaardingen near Rotterdam to improve service to its Western European customers, which accounted for about 50% of its overall business. The 10,000 t/yr operation included importing, processing, and sales functions for crude magnesite, caustic-calcined magnesia, and dead-burned magnesia. In addition to supplying material from Grecian Magnesite's facilities in Greece, it could supply material from Grecian Magnesite's affiliated companies in Spain and Turkey (Industrial Minerals, 2004c).

Turkey. Turkey's Siltaş Silis Kumlari Sanayi ve Ticaret A.Ş. acquired 100% of Olivin Mineral AS (a subsidiary of OlivinGroup). Olivin Mineral produced forsterite from deposits near the Marmara Sea but had been working at about 10% of capacity. By the end of June, the company installed additional flotation and hydrosizing capacity to increase the production capacity at the plant to 1,500 metric tons per hour and expected the plant to be at its full production capacity of 5 Mt/yr by September (O'Driscoll, 2004e).

Current Research and Technology

As part of U.S. Department of Energy-funded research, scientists at The Pennsylvania State University developed a method to modify serpentine to quickly remove carbon dioxide (CO_2) from flue gases generated by burning fossil fuels. Serpentine naturally sequesters CO_2 over geologic time; previous research on CO_2 sequestration used finely crushed serpentine, but it still took high temperatures to speed up the reaction. With the new process, the serpentine does not need to be crushed as finely, and the reaction gives off heat. In the new process, serpentine is dissolved in sulfuric acid, which converts the silicon in the mineral to silicon dioxide and the magnesium into magnesium sulfate. Treating some of this magnesium sulfate with sodium hydroxide also creates some magnesium hydroxide. The researchers were able to convert large quantities of the serpentine's magnesium to these chemicals, thereby providing large surface areas for reactions to take place in solution at room temperature. Passing the CO_2 gas stream through the magnesium sulfate-magnesium hydroxide solution produces magnesium carbonate (Pennsylvania State University, The, 2004§).

Outlook

According to the International Iron and Steel Institute (2005§), world steel production in 2004 increased by 8.8% from that in 2003, with China as the leading producer. Production in China increased by more than 23% and represented more than 25% of total world production. Increased iron and steel production in China could lead to more internal consumption of refractories, which would mean that less material would be available for export. Because the United States has lost much of its refractory magnesia production capacity in recent years and China is the principal U.S. supplier, a shortage of supply in the United States is possible. China, however, has vast resources of magnesite, and could increase magnesite production capacity to meet its internal and export needs.

Caustic-calcined magnesia markets are fairly mature, but use of magnesium hydroxide for environmental applications is growing. In its 2004 annual report, Martin Marietta reported that it had ramped up production sharply to support increased sales of magnesium hydroxide slurry for use in wastewater treatment and flue gas scrubbing at powerplants. Because of its superior properties, magnesium hydroxide is expected to continue to replace material such as lime and caustic soda in some environmental applications.

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TABLE 1

SALIENT MAGNESIUM COMPOUND STATISTICS[1]

(Thousand metric tons and thousand dollars)

	2000	2001	2002	2003	2004
United States:					
Caustic-calcined and specified magnesias:[2]					
Shipped by producers:[3]					
Quantity	172	136	127	154	132
Value	46,000	43,300	38,100	61,000	55,400
Exports[4]	12	4	6	4	4
Imports for consumption[4]	136	130	148	150	157
Refractory magnesia:					
Shipped by producers:[3]					
Quantity	196	213	123	81	W
Value	68,100	71,300	37,800	23,500	W
Exports	60	63	73	56	30
Imports for consumption	501	363	394	379	418
World, production of magnesite	12,700	11,100	13,600 r	14,000 r	14,500 e

eEstimated rRevised W Withheld to avoid disclosing company proprietary data.

[1]Data are rounded to no more than three significant digits.

[2]Excludes caustic-calcined magnesia used in the production of refractory magnesia.

[3]Includes magnesia used by producers.

[4]Caustic calcined magnesia only.

TABLE 2

U.S. MAGNESIUM COMPOUND PRODUCERS, BY RAW MATERIAL SOURCE, LOCATION, AND PRODUCTION CAPACITY, IN 2004[1]

(Metric tons of MgO equivalent)

Raw material source and producing company	Location	Capacity	Products
Brucite: Applied Chemical Magnesias Corp.	Van Horn, TX, and Bullhead City, AZ.	25,000	Magnesium hydroxide.
Magnesite: Premier Chemicals LLC	Gabbs, NV	140,000	Caustic calcined magnesia.
Lake brines:			
Great Salt Lake Minerals Corp.	Ogden, UT	106,000	Magnesium chloride and magnesium chloride brines.
Intrepid Mining LLC	Wendover, UT	48,000	Magnesium chloride brines.
Well brines:			
Martin Marietta Magnesia Specialties LLC[2]	Manistee, MI	297,000	Caustic calcined and dead burned magnesia.
Rohm and Haas Co.	do.	25,000	Magnesium hydroxide and caustic calcined magnesia.
Seawater:			
Premier Chemicals LLC	Port St. Joe, FL.	107,000	Caustic calcined magnesia and magnesium hydroxide.
SPI Pharma Inc.	Lewes, DE	5,000	Magnesium hydroxide.
Western Salt Co.	Chula Vista, CA	3,000	Magnesium chloride brines.
Total		751,000	

[1]Data are rounded to no more than three significant digits; may not add to total shown.

[2]In addition to its Michigan plant, Martin Marietta owned a 15,000-metric ton-per-year capacity magnesium hydroxide plant in Lenoir City, TN, which used imported magnesite as a raw material.

TABLE 3

U.S. MAGNESIUM COMPOUNDS SHIPPED AND USED[1]

	2003		2004	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined and specified (USP and technical) magnesias[2]	154,000	$61,000	132,000	$55,400
Magnesium hydroxide [100% $Mg(OH)_2$][2]	217,000	101,000	113,000	60,700
Magnesium sulfate, anhydrous and hydrous	40,000	14,400	53,700	15,200
Precipitated magnesium carbonate[2]	1,470	3,500	105	475
Refractory magnesia	84,400	23,500	W	W

W Withheld to avoid disclosing company proprietary data.

[1]Data are rounded to no more than three significant digits

[2]Excludes material produced as an intermediate step in the manufacture of other magnesium compounds

TABLE 4
YEAREND MAGNESIUM COMPOUND PRICES

Material		2003	2004
Magnesia, dead burned	per short ton	$363-368	$365-375
Magnesia, synthetic, technical, 98% MgO	do	488	490
Magnesium chloride, hydrous, 99%, flake	do	290 r	290
Magnesium chloride, anhydrous, 92%, flake or pebble	per pound	0.1275-0.15 r	0.1275-0.15
Magnesium hydroxide, powder, technical	do	0.45	0.45
Magnesium hydroxide slurry, technical, 100% $Mg(OH)_2$	do	235-240	238-250
Magnesium sulfate, technical (epsom salts)	do	0.18-0.215	0.18-0.215
Olivine, aggregate, free on board plant or mine	per metric ton	50-78	50-78
Olivine, foundry grade, free on board plant or mine	do	62-109	62-109

rRevised; prices for hydrous and anhydrous magnesium chloride in the 2003 Minerals Yearbook chapter were switched.

Sources: Chemical Market Reporter and Industrial Minerals.

TABLE 8

U.S. EXPORTS OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY[1]

	2003		2004	
Material and country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic-calcined magnesia:				
France	1,850	$1,060	1,300	$752
Germany	308	177	412	230
Netherlands	1,180	678	1,330	696
Other	727 r	417 r	674	517
Total	4,060	2,330	3,720	2,200
Dead-burned and fused magnesia:				
Brazil	1,010	1,320	286	294
Canada	48,900	15,200	23,500	8,020
France	1,130	736	435	270
Germany	314	202	462	278
Korea, Republic of	575	389	417	267
Mexico	622	366	574	573
Netherlands	1,120	759	814	561
Taiwan	693	378	618	359
United Kingdom	435	352	577	5,240
Venezuela	309	93	612	215
Other	1,400 r	1,120 r	1,650	1,200
Total	56,500	20,900	29,900	17,300
Other magnesia:				
Canada	7,060	2,480	6,320	3,090
Colombia	1,530	530	67	140
Germany	348	360	820	834
Hong Kong	656	800	393	426
Indonesia	1,200	665	1,240	734
Japan	5,310	4,320	3,020	2,530
Mexico	3,670	3,220	3,100	2,980
Taiwan	3,480	1,830	4,780	2,700
United Kingdom	433	544	834	1,010
Venezuela	996	349	34	65
Other	2,850 r	3,750 r	2,890	3,710
Total	27,500	18,800	23,800	18,200
Crude magnesite:				
Argentina	1,320	141	772	78
Australia	60	6	4,030	465
Canada	1,300	181	3,940	509
France	1,810	193	4,730	511
Germany	29	3	1,650	176
Mexico	1,020	109	598	63
United Kingdom	4,340	481	97	10
Venezuela	6,140	701	2,710	320
Other	1,930 r	219 r	964	111
Total	18,000	2,030	19,500	2,250

rRevised.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 6
U.S. EXPORTS OF MAGNESIUM COMPOUNDS[1]

	2003		2004		
Material	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Principal destinations, 2004
Magnesium chloride, anhydrous and other	8,150	$4,020	5,100	$3,390	Canada, 78%.
Magnesium hydroxide and peroxide	13,700	8,850	15,700	10,100	Canada, 61%, Germany, 11%
Magnesium sulfate, natural kieserite and epsom salts	2,460	1,060	11,900	1,140	Canada, 99%.
Magnesium sulfate, other	6,970	3,080	8,450	3,520	Canada, 87%

[1]Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau

TABLE 7

U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND PROCESSED MAGNESITE, BY COUNTRY[1]

	2003		2001	
Material and country	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Caustic calcined magnesia:				
Australia	786	$383	1,670	$597
Brazil	--		1,000	296
Canada	44,100	7,550	55,500	9,300
China	92,700	9,550	96,400	11,300
Greece	11,000	2,870		
Other	1,440 r	2,230 r	830	671
Total	150,000	22,600	157,000	22,200
Dead burned and fused magnesia:				
Australia	23,000	5,440	10,800	3,270
Austria	15,600	7,630	27,700	14,600
Brazil	--	--	6,000	770
China	310,000	49,800	341,000	71,000
Greece	5,210	1,110	2,650	500
Hong Kong	6,160	1,330	5,300	992
Israel	2,500	5,540	2,760	5,120
Japan	1,610	2,680	3,390	5,340
Mexico	6,090	1,950	11,800	3,970
Netherlands	3,720	1,070	4,550	1,540
Other	5,370 r	1,970 r	2,120	1,600
Total	379,000	78,500	418,000	109,000
Other magnesia				
Canada	1,690	346	1,900	428
China	9,660	1,970	3,160	1,480
Israel	680	1,110	859	1,430
Japan	2,010	3,210	1,760	3,090
Mexico	1,490	898	2,010	1,120
Slovakia	4,620	1,670	3,870	1,210
Other	890	1,090	2,100	2,050
Total	21,000	10,300	15,700	10,800
Crude magnesite:				
Brazil	--	--	541	200
Canada	2,460	169	6,180	404
China	7,590	566	6,100	618
Japan	2,370	531	2,320	500
Korea, Republic of	954	270	412	179
Other	956 r	207 r	353	78
Total	14,300	1,740	15,900	1,980

r Revised. -- Zero.

[1] Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 8

U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM COMPOUNDS[1]

	2003		2004		
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Principal sources, 2004
Magnesium chloride, anhydrous and other	60,400	$13,200	83,800	$15,200	Israel, 74%; Germany, 21%
Magnesium hydroxide and peroxide	5,220	8,510	6,390	10,800	Netherlands, 29%, Israel, 22%; Austria, 18%
Magnesium sulfate, natural epsom salts	555	153	1,040	289	China, 81%
Magnesium sulfate, natural kieserite	13,100	653	10,800	558	Germany, 100%
Magnesium sulfate, other	32,800	13,200	30,100	13,700	Germany, 45%, Canada, 33%, China, 19%

[1]Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 9
WORLD MAGNESIUM COMPOUNDS ANNUAL PRODUCTION CAPACITY,
DECEMBER 31, 2004[1,2]

(Thousand metric tons of MgO equivalent)

	Raw material				
	Magnesite		Seawater or brines		
Country	Caustic-calcined	Dead-burned	Caustic calcined	Dead burned	Total
Australia	128	110			238
Austria	25	250			275
Brazil	80	291			371
Canada	150	--			150
China	200	2,500		10	2,710
France			30		30
Greece	120	100			220
India	28	267			295
Iran		30			30
Ireland		--		90	90
Israel	--	--	10	60	70
Italy	25				25
Japan			50	250	300
Jordan			10	50	60
Korea, North		1,150			1,150
Korea, Republic of		--	--	40	40
Mexico			15	95	110
Netherlands			10	150	160
Poland		10			10
Russia	100	2,670			2,770
Serbia and Montenegro	40	160			200
Slovakia	--	465	--	--	465
South Africa	12	--	--		12
Spain	160	70			230
Turkey	25	365			390
Ukraine		120	20	80	220
United Kingdom	--	--	70		70
United States	140	--	201	195	536
Zimbabwe	20				20
Total	1,250	8,560	416	1,020	11,200

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes capacity at operating plants, as well as at plants on standby basis.

TABLE 10
MAGNESITE: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country	2000	2001	2002	2003	2004[e]
Australia	349,783	605,314	484,498	472,668	325,402 [r]
Austria, crude[3]	726,000 [r]	700,000	700,000	700,000	700,000
Brazil, beneficiated	279,876	265,749	269,222	269,000 [e]	269,000
Canada[e, 4]	180,000	180,000	180,000	180,000	180,000
China[e]	4,070,000	3,580,000	4,560,000 [r]	4,600,000 [r]	4,650,000
Colombia[e]	10,500	10,500	10,500	10,500	10,500
Greece, crude[e]	500,000	500,000	500,000	500,000	500,000
India[e]	365,080 [r]	370,000	380,000	380,000	370,000
Iran[5]	141,000 [r, 5]	133,778	128,565 [r]	130,000 [e]	135,000
Korea, North[e]	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Mexico	335	250			
Pakistan[e]	4,192 [r]	4,200	4,000	4,200	4,200
Poland, concentrate	26,100	22,200	22,100	22,000 [r]	22,000
Russia[e]	1,000,000	1,000,000	1,000,000	1,200,000	1,200,000
Serbia and Montenegro, crude	41,000	36,000	33,000 [r]	25,000 [r, e]	25,000
Slovakia, concentrate	1,000,000	961,000	929,630 [r]	993,900 [r]	995,000
South Africa	63,000	36,500	87,200 [r]	86,100 [r]	85,000
Spain, calcined[e]	266,000 [r]	260,000	250,000	250,000	250,000
Turkey, run-of-mine	2,672,089	1,450,031	3,044,430	3,224,278 [r]	3,800,000
United States	W	W	W	W	W
Zimbabwe	4,029	2,439	2,366	1,333 [r]	749 [r]
Total	12,700,000	11,100,000	13,600,000 [r]	14,000,000 [r]	14,500,000

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total". -- Zero.

[1]World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Figures represent crude salable magnesite. In addition to the countries listed, Bulgaria produced magnesite, but output is not reported quantitatively, and available information is inadequate for formulation of reliable estimates of output levels. Table includes data available through May 13, 2005.

[3]Reported figure.

[4]Magnesitic dolomite and brucite. Figures are estimated on the basis of reported tonnage-dollar value.

[5]Year beginning March 21 of that stated.